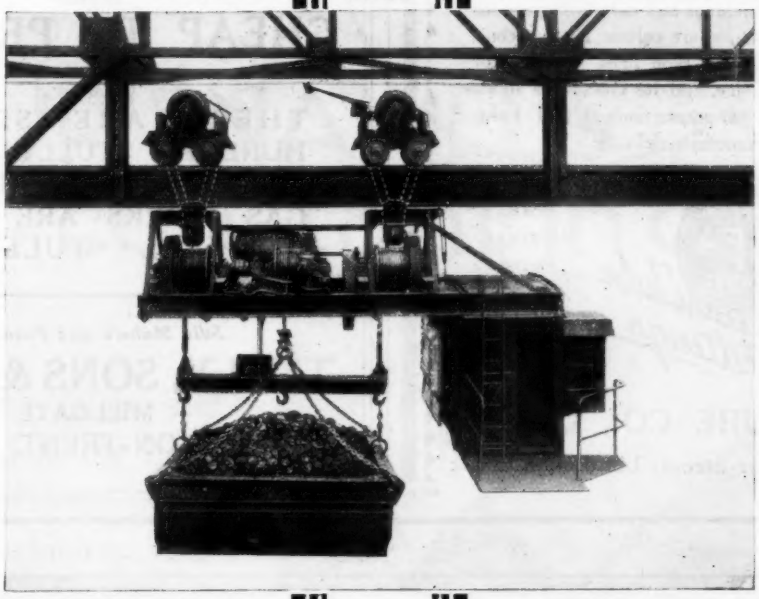
GAS JOURNAL

LIGHT . HEAT . POWER . BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

Vol. 203. 85th Year. LONDON, SEPTEMBER 20, 1933. No. 3670. Price 1s.

ELECTRIC ALL TYPES | **TELPHERS** ALL CAPACITIES



For Direct or Remote Control

For handling Coal, Coke, Oxide, etc., by means of Skips or Grabs.

The illustration shows a 7-Ton Gross Load, three barrel machine for handling coke from Intermittent Vertical Retorts.

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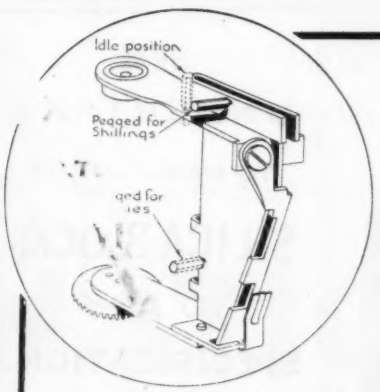

Illustration shows the coin pocket of a "Chelsea Two" Meter which normally takes both pennies and shillings. Note the simple screw peg which enables the Meter to be restricted to take pennies only or shillings only.

The Gas Meter which takes PENNIES *and* SHILLINGS

and can be easily restricted to take

PENNIES ONLY OR SHILLINGS ONLY

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"CHELSEA TWO"

GEORGE GLOVER & CO., LTD.

Dry Meter Manufacturers and Repairers

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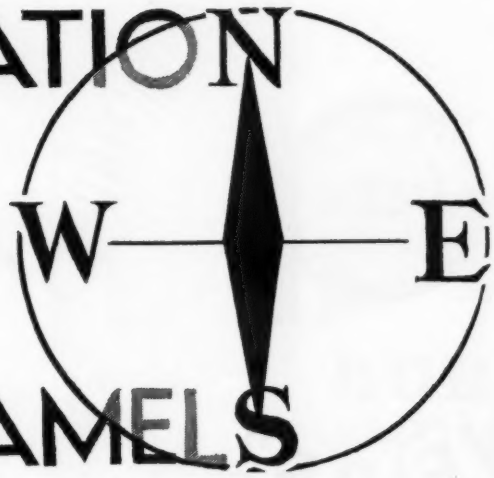

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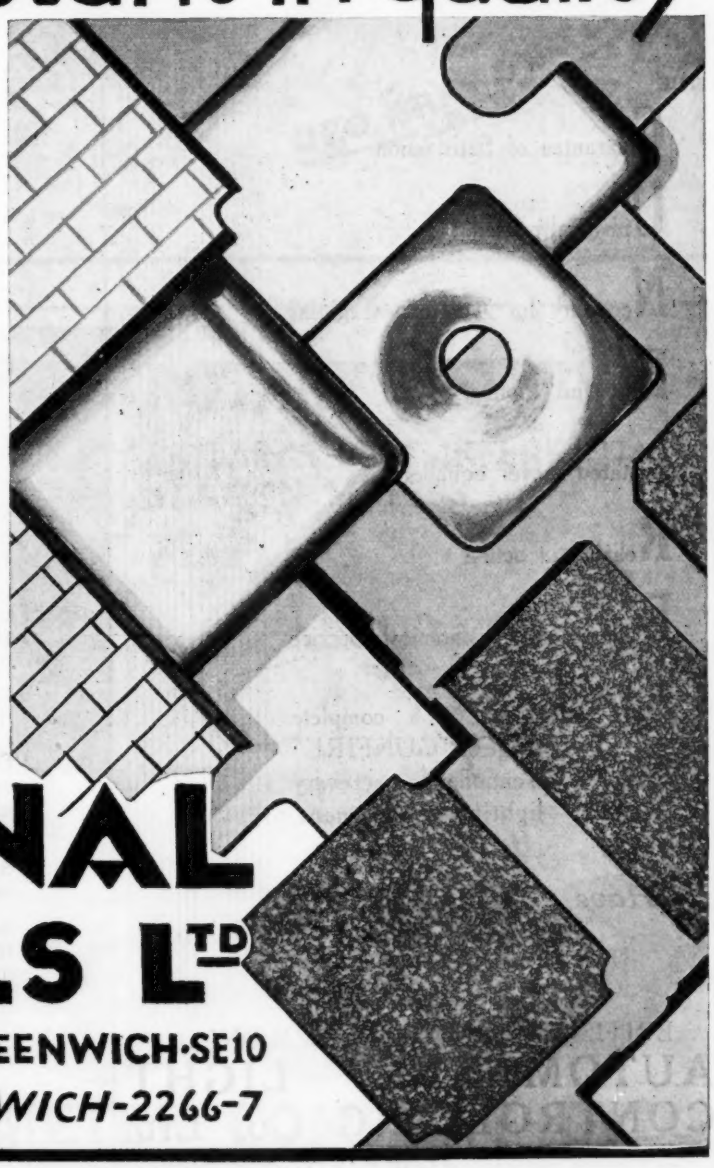

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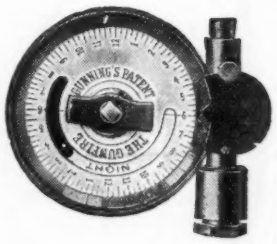

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This combination is the
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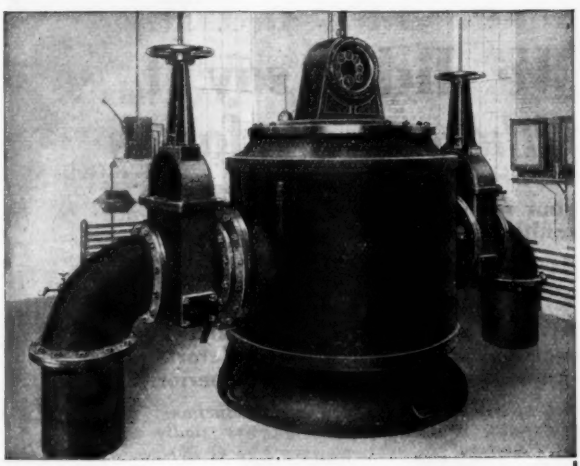

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TYPE G LANTERN WITHOUT MOR-LITE REFLECTOR

The Parkinson
MOR-LITE DIRECTIONAL
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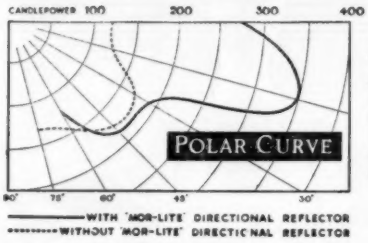

The curve shows the Directional Increase in Illumination at no extra cost for Gas

TYPE G LANTERN WITH MOR-LITE REFLECTOR

1. THE "MOR-LITE" DIRECTIONAL REFLECTOR increases the candle power by reflection at low angles where light is most needed.
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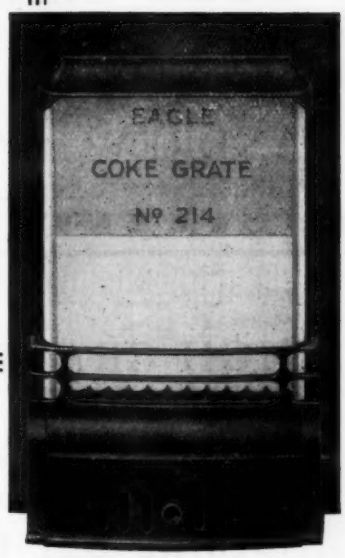

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EAGLE GAS-COKE GRATES will yield you substantial business this Winter. Thousands of people only need to know the advantages of these grates over coal fires to have them installed—and up go your sales of household coke.

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140 *Therms per ton of coal,* **400** *B.Th.U. Gas*

NO CLINKERING.

THE MOORE GAS PLANT

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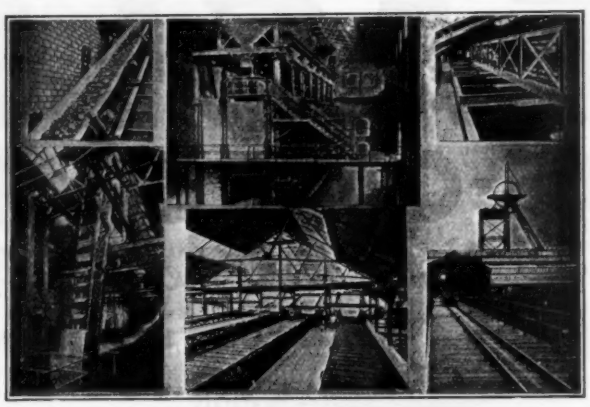

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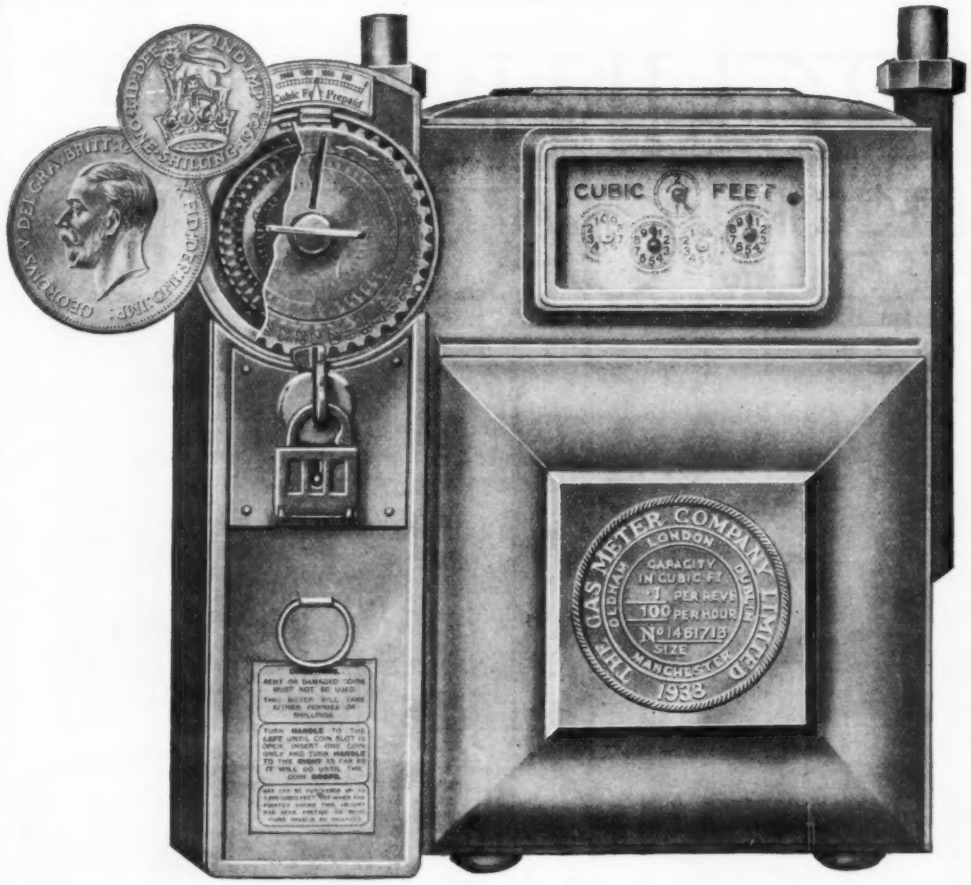
The "Portcullis" series of gas-fires shows remarkable gains in radiant efficiency and has been received with enthusiasm by the Gas Industry.



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PENNY OR **SHILLING** IN SAME SLOT AT CONSUMER'S OPTION OR CAN BE CONVERTED TO "SINGLE COIN" IN SITU BY YOUR OWN FITTER IN ONE SIMPLE OPERATION. ONE TYPE OF METER MEETS THREE DEMANDS.

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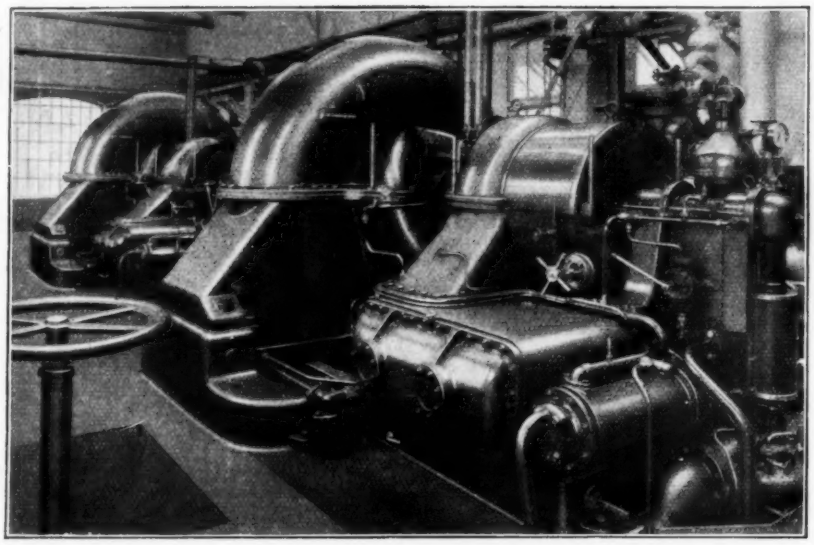

Illustrated above are two Turbo Boosters with capacities of 2,000,000 cubic feet of gas per hour each. They are direct-coupled to Steam Turbines.

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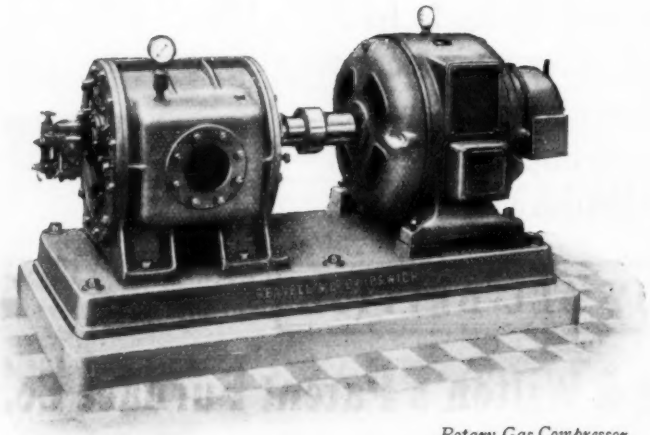

Rotary Gas Compressor. 120,000 cu. ft. per hour.

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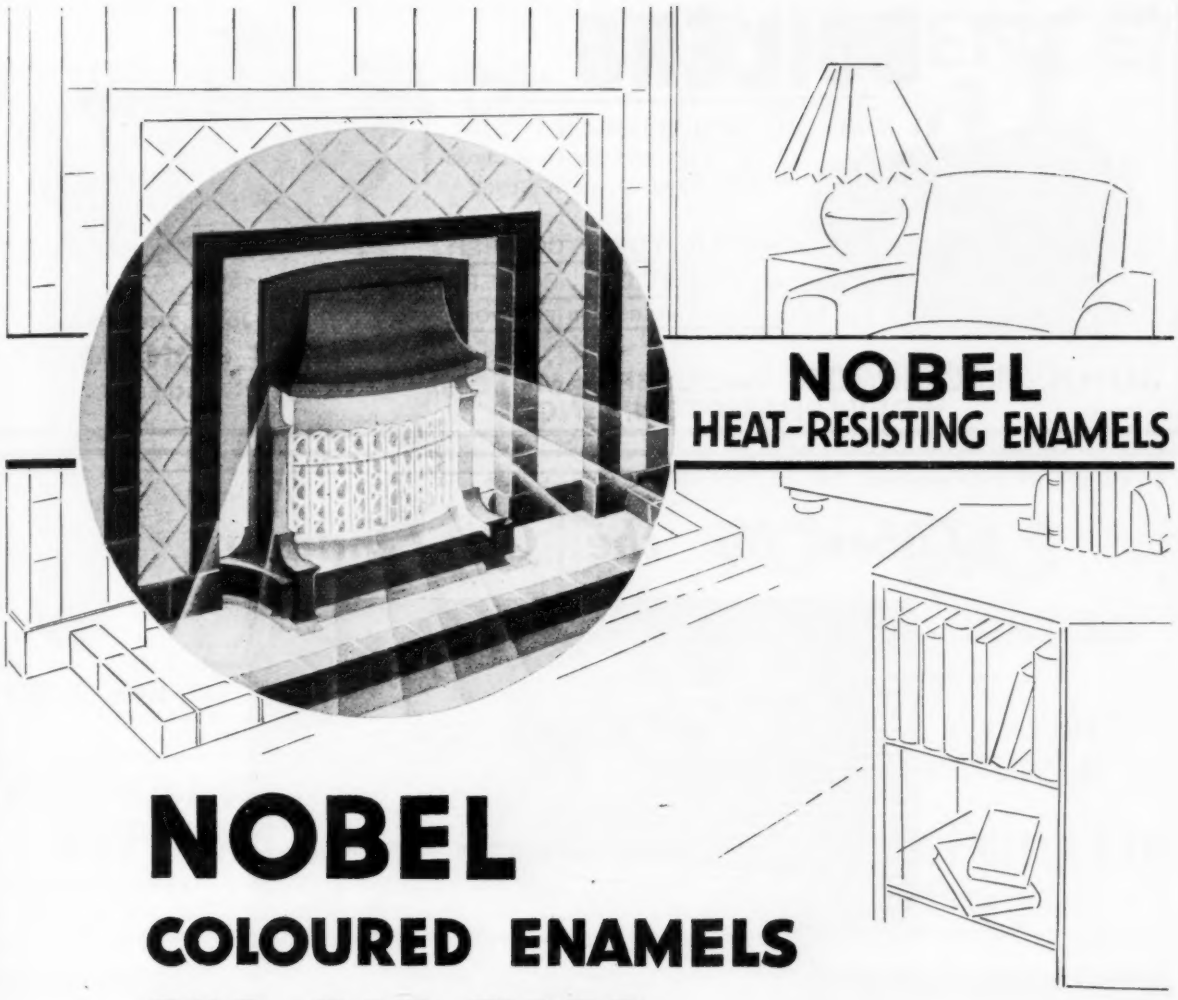

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HEAT-RESISTING ENAMELS

NOBEL
COLOURED ENAMELS FOR GAS FIRES

The days of the Black gas fire are over. Now a coloured fire is demanded that will harmonise with the rest of the furnishing of the room.

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Write for full particulars of Nobel Heat-Resisting Enamels for Gas Fires to the Industrial Division :—

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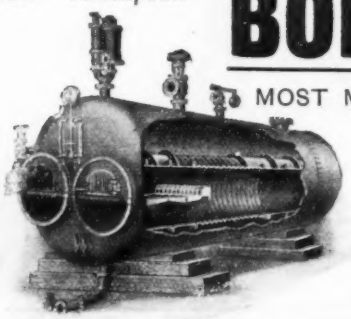

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MOST MODERN "DISH-END" TYPE
WITH CORRUGATED SECTIONS
Standard Sizes in Stock
ALSO
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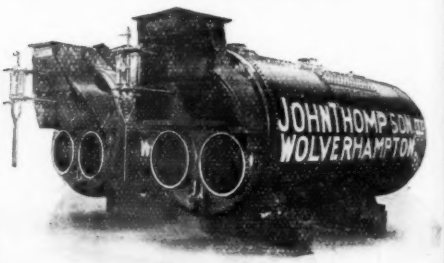

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"ECONOMIC"
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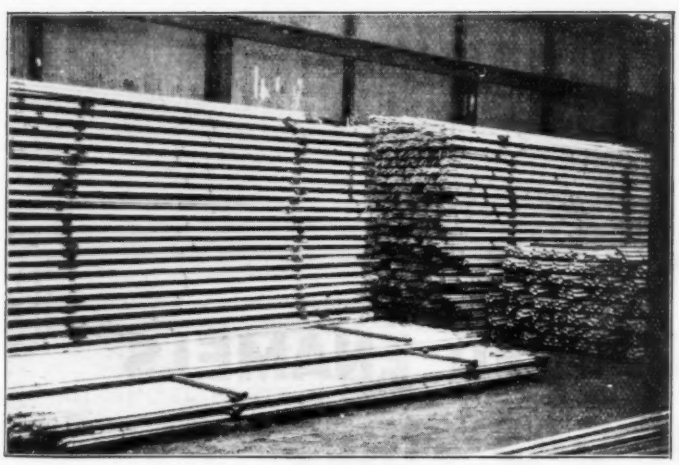
Tubes for the Gas Industry



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TRADE MARK.

Fig. 705 "SINGLE RAM" STEAM-PUMP.

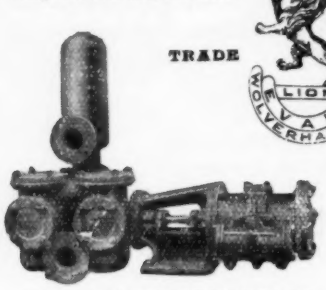


Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

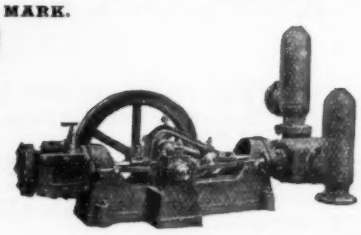


Fig. 685. "RELIABLE" STEAM PUMP FOR TAR AND THICK FLUIDS.

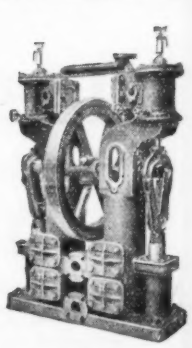
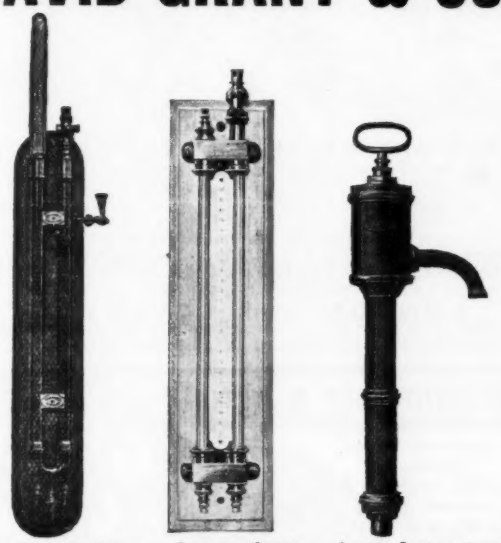


Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

ESTABLISHED 1858.

DAVID GRANT & CO.



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BRADFORD

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For many years past, discerning Gas Managers up and down the country have found that Staveley Prepared Oxide of Iron gives unusually good results in their Purifier Plants.

This is due to the fact that this well-tried Staveley product is a **VIRGIN* material, specially and solely prepared for Gas Works use.

It is delivered ready for use and, whilst by no means expensive, it gives consistently good results.

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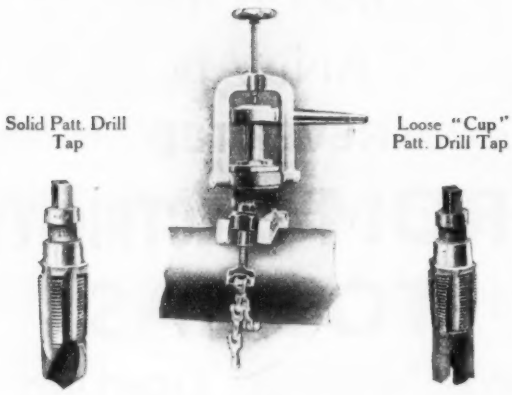
NEAR CHESTERFIELD

The Largest Main-Laying Contractors in the Country use
"Abbirko" Central Action Drill Stands and Tools



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They use them **All day and Every day** knowing that better machines and tools are unprocurable.

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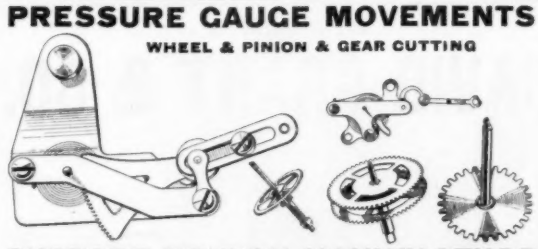

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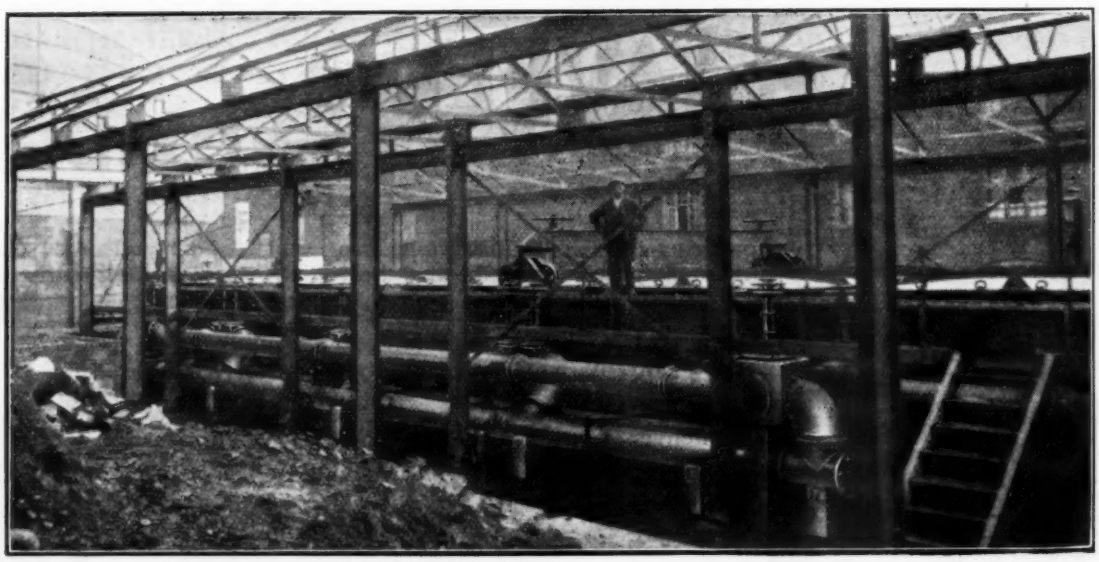

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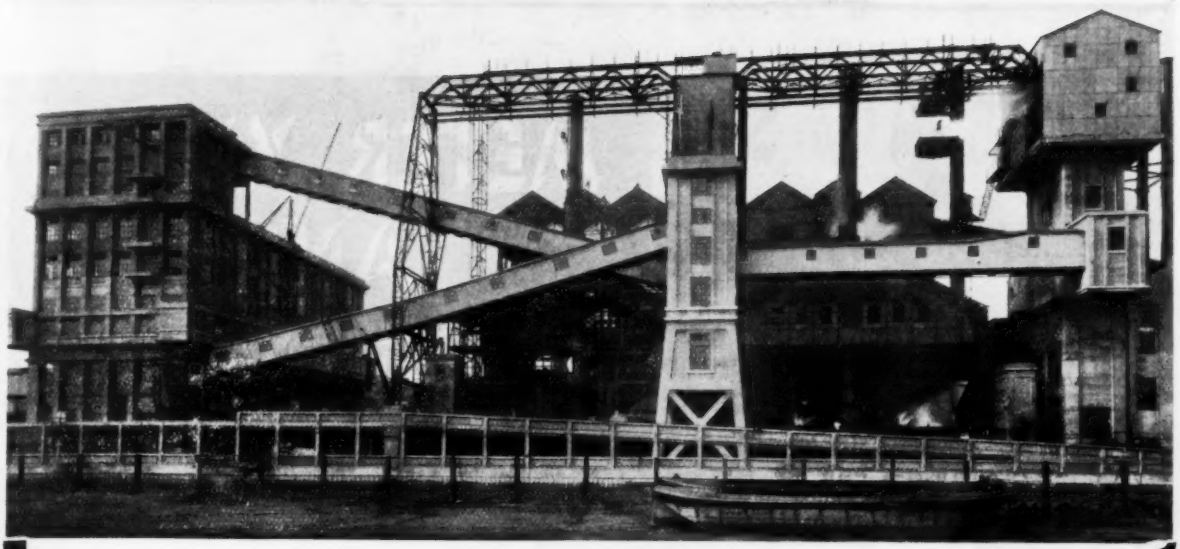

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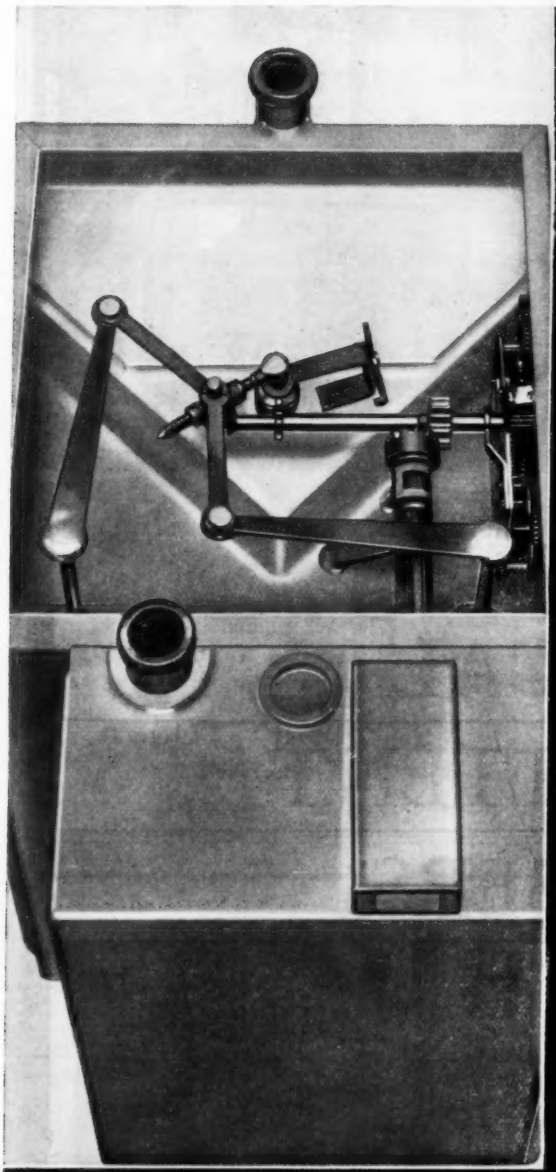

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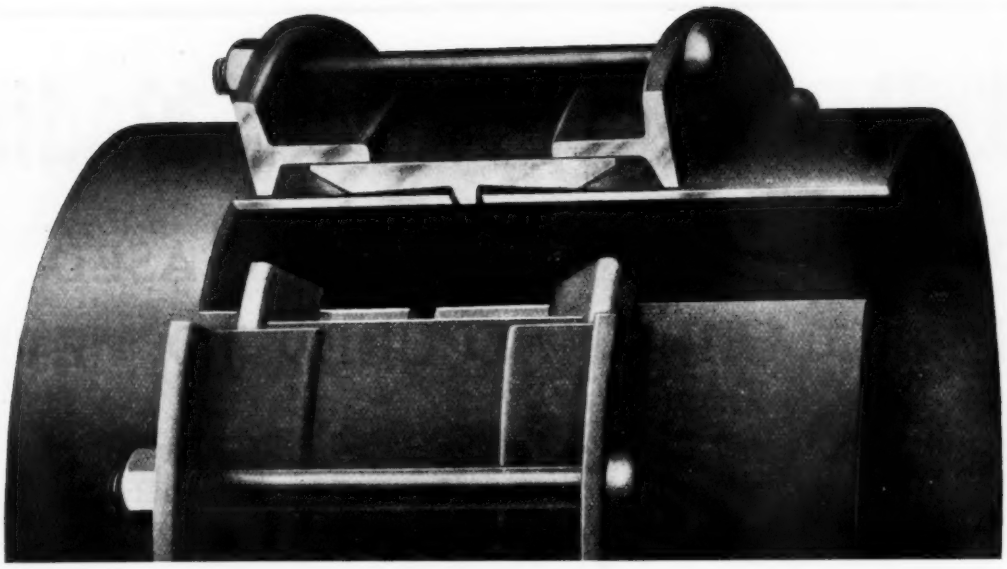

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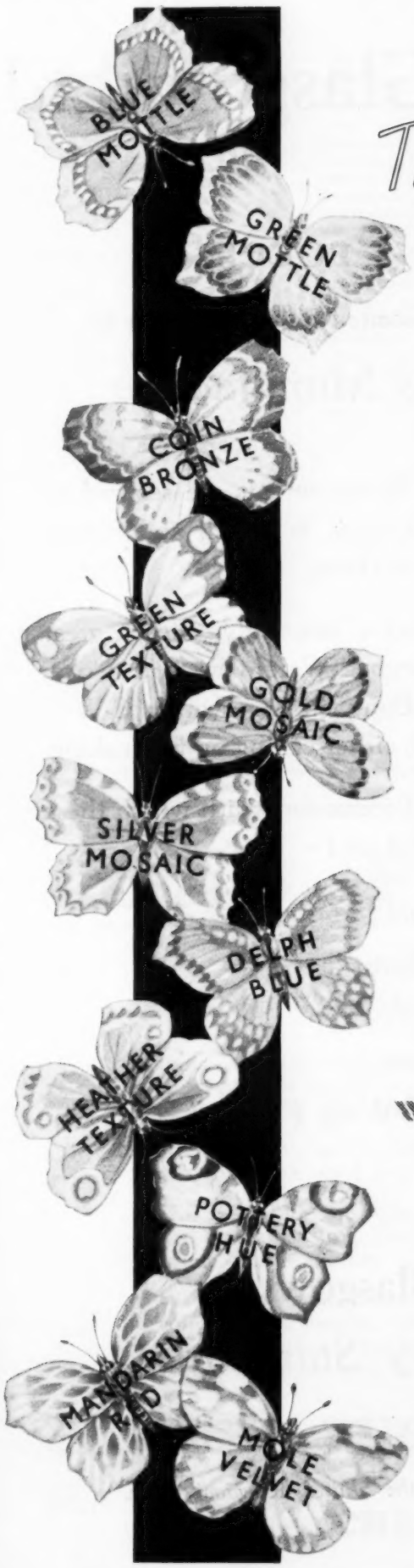

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CONTENTS

EDITORIAL NOTES.

A GLANCE AT THE CONTENTS . . . 611
Ammoniacal Liquor Treatment 612
Unusual Difficulties 612
Complete Gasification Up-to-Date 613
Very Ancillary Plant 613

Forthcoming Engagements 611
Personal 614
Obituary 614
Book Review 614

CORRESPONDENCE.

High-Pressure Gasholders 614
Organizing for Selling 614

NEWS OF THE WEEK.

Paragraphs 615
Manchester District Association of Gas Engineers 615
Yatton Street Lighting 615
Dramatic Cookery Demonstrations . . . 616
Works, Roads, and Transport Congress . . 616

NEWS OF THE WEEK—(*continued*).

Pushing the Automatic Water Heater—Bristol's Live Campaign 616
Gas Continues to Light South Molton Streets 617
Diesel Locomotive Runs on British Coal-Oil 617
Liverpool All-Gas House 617
Instruction in Metallurgy 617
New Waterless Holder at St. Helens . . . 617
Institute of Fuel—October Meetings in London 618
Alleged River Pollution by Gas-Works—Town Council Sued 618
Ministry of Health Inquiry at Stalybridge—Mossley's Offer to Supply Gas 618
Gas-Works to Sell its Waste Heat—Manchester Greenhouse-Heating Scheme . . 619
Street Lighting in Manchester—More Automatic Controllers in Use 619
National Gas Council—Meeting of Central Executive Board 619

SPECIAL ARTICLES, &c.

Tully Gasification Plant with Waste-Heat Boiler and Automatic Operator. By Walter T. Dunn, M.I.Mech.E. 620
Smoke Abatement in Sheffield 622

SPECIAL ARTICLES, &c.—(*continued*).

North British Association of Gas Managers—Trade Wastes from Gas-Works. By Alexander McDonald, B.Sc. 623
Association of Public Lighting Engineers—Development of Public Lighting in the City of Bombay. By J. P. Blackmore . . 627
Notes on Plant and Processes 629
Testing Radiant Efficiency of Gas Fires . . 630

REGISTER OF PATENTS.

Automatic Neutralizing Control—W. C. Holmes & Co., Ltd., Cooper C., and Henshaw, D. M. 631
Prepayment Mechanism—Meters, Ltd., and Barlow, G. 631

MISCELLANEOUS.

Corporation Undertakings' Results . . . 632

GAS MARKETS AND MANUFACTURES.

Stock Market Report 632
Current Sales of Gas Products 632
Trade Notes 632

Stock and Share List 633

For Advertisers' Index see End of "JOURNAL"—PAGE 639.

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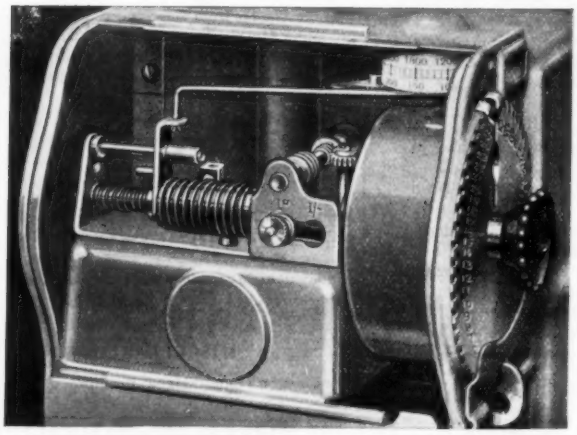

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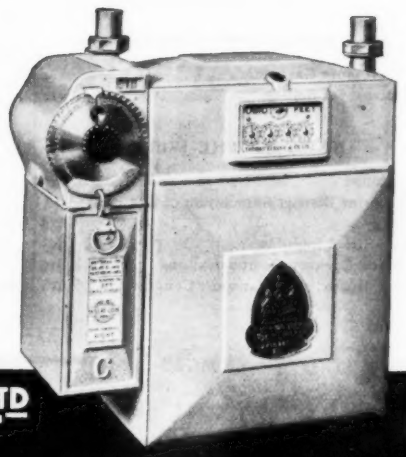

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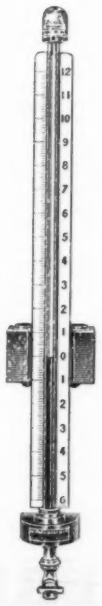

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THE GAS JOURNAL

SEPTEMBER 20, 1933

Vol. 203. 85th Year No. 3670

A Glance at the Contents—

Testing Radiant Efficiency of Gas Fires.

Details are given of a bolometer outfit for testing the radiant efficiency of gas fires. [p. 630.]

Tully Gasification Plant.

Mr. Walter T. Dunn, M.I.Mech.E., describes in detail the Tully Gasification Plant in conjunction with waste-heat boiler and automatic operator. [p. 620.]

Somerset Resort Requires Secretary.

Applications are invited for the position of Secretary to the Weston-super-Mare Gaslight Company at a commencing salary of £500 per annum. [p. 636.]

Trade Wastes from Gas-Works.

In a paper before the North British Association of Gas Managers on Sept. 7, Mr. A. McDonald, of Motherwell, puts forward a few thoughts on this aspect of the Industry which has seriously exercised many gas engineers for some considerable time. [p. 623.]

Public Works, Roads, and Transport Congress.

A session at the seventh Public Works, Roads, and Transport Congress, which is to be held at the Royal Agricultural Hall, London, from Nov. 13-18, will be devoted to the Gas Industry. The session is held under the auspices of the Institution of Gas Engineers. [p. 616.]

A Water Heater Campaign.

Details are given of the efforts which the Bristol Gas Company are making to sell the smaller type of automatic gas water heater. They are certainly "going all out" to secure this valuable load. [p. 616.]

Mossley's Offer to Supply Stalybridge.

As a result of the offer by Mossley to supply Stalybridge with gas in bulk from their new works, a Ministry of Health Inquiry was held into Stalybridge's application for sanction to borrow £18,000 for new carbonizing plant. [p. 618.]

National Gas Council.

A meeting of the Central Executive Board of the National Gas Council was held at 28, Grosvenor Gardens, S.W. 1, on Tuesday, Sept. 12. In the absence of Sir David Milne-Watson, the chair was taken by Major G. H. Kitson. [p. 619.]

Public Lighting in Bombay.

In a paper before the Association of Public Lighting Engineers, Mr. J. P. Blackmore, Public Lighting Superintendent to the Bombay Gas Company, shows how Bombay was able to introduce modern efficient and economical illuminants without any material additional burden upon the taxpayer. [p. 627.]

Forthcoming Engagements

Sept. 22.—I.G.E.—Meetings of Liquor Effluents and Ammonia Sub-Committee, 10.30 a.m.; Joint Research Committee, 2.45 p.m., 28, Grosvenor Gardens, S.W. 1.

Sept. 22.—GAS COMPANIES' PROTECTION ASSOCIATION.—Meeting of Committee, 5, Victoria Street, S.W. 1, 2.30 p.m.

Sept. 25-27.—B.C.G.A.—Annual Conference at Bournemouth.

Sept. 29.—I.G.E.—Meeting of General Research Committee, 2.30 p.m., 28, Grosvenor Gardens, S.W. 1.

Oct. 6.—NORTH OF ENGLAND ASSOCIATION.—Autumn Meeting at South Shields.

Oct. 12.—SOUTHERN ASSOCIATION (EASTERN DISTRICT).—Meeting at 28, Grosvenor Gardens, S.W. 1, 2.30 p.m. Subject for discussion: "Coal Blending."

Oct. 17.—I.G.E.—Meetings of Board of Examiners, 2.30 p.m.; Publications Committee, 3 p.m.; Education Executive Committee, 4 p.m., 28, Grosvenor Gardens, S.W. 1.

Oct. 19.—S.B.G.I.—Meeting of Council in the afternoon.

Oct. 27.—MANCHESTER DISTRICT ASSOCIATION.—General Meeting, Midland Hotel, Manchester, 2.30 p.m.

Nov. 6.—I.G.E.—Meetings of Finance Sub-Committee, 2 p.m.; Membership Sub-Committee, 2 p.m.; General Purposes Committee, 3 p.m.; Council, 4.15 p.m., 28, Grosvenor Gardens, S.W. 1.

Nov. 7-8.—I.G.E.—Autumn Research Meeting, Institution of Mechanical Engineers.

Nov. 9.—S.B.G.I.—Autumn General Meeting, Hotel Metropole, London.

Nov. 14.—I.G.E.—Session at the Public Works, Roads, and Transport Congress and Exhibition, Royal Agricultural Hall, 11 a.m.; Joint Session of the Institution and the Association of Public Lighting Engineers, 3 p.m.

Nov. 14.—I.G.E.—Meeting of Gas Education Committee, 5 p.m., 28, Grosvenor Gardens, S.W. 1.

Dec. 11.—I.G.E.—Meetings of Finance Sub-Committee, 2 p.m.; Membership Sub-Committee, 2 p.m.; General Purposes Committee, 3 p.m.; Benevolent Fund Committee of Management, 4.30 p.m., 28, Grosvenor Gardens, S.W. 1.

Dec. 12.—I.G.E.—Meetings of Council, 10 a.m.; Gas Education Executive Committee, 4 p.m., 28, Grosvenor Gardens, S.W. 1.

Dec. 21.—I.G.E.—Meeting of Refractory Materials Joint Sub-Committee, 2.30 p.m., 28, Grosvenor Gardens, S.W. 1.

EDITORIAL NOTES

Ammoniacal Liquor Treatment

AT the meeting of the North British Association an important paper was read which will be of great service to gas engineers who are experiencing difficulty in dealing with their ammoniacal liquor, and which should be studied carefully by those who may at the moment be fortunately placed in regard to disposal of liquor. The whole problem of effluents disposal has, of course, become complicated owing to the decline in sulphate of ammonia manufacture, and many methods of disposal of ammoniacal liquor have been proposed and practised. These methods fall into four groups. First, there is the possibility of discharging the whole of the liquor into the town sewerage system, and in certain circumstances this can be accomplished without trouble provided that adequate storage facilities are arranged at the gas-works, care is taken to ensure a minimum toxicity of the liquor by early separation of tar and liquor, and due regard is had to a regulated, properly proportioned flow of diluted liquor to the sewer. There is testimony that, under certain conditions, raw liquor can be treated in this manner without placing undue strain on the sewage works. At Wolverhampton, for instance, raw liquor can be tolerated quite as well as spent liquor; and at Tipton the whole of the ammoniacal liquor from the gas-works is taken on to the sewage filters without impairing their good condition. Circumstances differ, however, from place to place, and the problem cannot be settled so easily.

The second plan is to destroy, or partially destroy, the raw liquor at the gas-works. It can be destroyed by use for quenching coke, by using it on producer furnace bars in place of water, by spraying it into hot waste gas flues. None of these methods provides an adequate solution to the problem, though each may serve temporarily as a palliative. Each is inevitably accompanied by serious disadvantages, and the destructive plan should not be adopted without first exploring other channels of disposal. The third method is to purify the liquor or the effluent at the gas-works, but in general this cannot be deemed an economic proposition, though the treatment may have to be carried out in special cases. In any event it is in the nature of an imposition. Finally, the liquor can be treated to produce not sulphate of ammonia, but concentrated ammonia; and this plan is to be recommended on all grounds. Several efficient and economical concentration plants are now available. The day of the small sulphate of ammonia unit is over; the need now is for centralized production at modern and highly efficient plants, liquor being concentrated and sent from the smaller works for working up into various ammonia products.

In the paper which has evoked these comments, Mr. A. McDonald, Engineer and Manager to the Motherwell and Wishaw Gas Department, explains very clearly the difficulties with which he was faced, how he arrived at the conclusion that the best thing he could do was to install a plant for producing concentrated ammonia, and the successful outcome of his decision. His lucid grasp of the situation will, as we have said, help others. In the early part of his contribution he rightly calls attention to the fact—insufficiently appreciated—that the oxygen-absorption figure of a liquor or an effluent is alone not a true guide to the sewage authority. For instance, a liquor containing much thiocyanate will be more difficult to deal with than one of the same oxygen absorption containing much phenol or higher tar acids. Also, he is at pains to point out the special circumstances of his own case—that he supplies gas to a united Burgh from a central manufacturing station at Motherwell, while the sewage works into which all the effluent flows only serves a portion of the Motherwell area, and that the gas-works are in close proximity to the sewage works, so that there is neither adequate mixing nor the normal dilution. Taking these considerations into account, all, we feel, will agree with Mr. McDonald's action. The plant he has installed is similar to that described by Mr. R. J. Philp at the 1932 meeting of the North British Association—a plant low in steam consumption, automatic in operation, and which virtually requires no labour. It has proved eminently satisfactory, though we would call attention to what Mr. McDonald says about the waste gases. The Alkali Inspector was not satisfied that the arrangements for treating the waste gases were ideal, and it was ultimately agreed to put in a small purifier with connections to both the concentrated and raw liquor tanks. This purifier, as in sulphate manufacture, ensures that no sulphuretted hydrogen goes forward to the atmosphere, and has now been adopted as standard.

The outcome of the installation of the plant is simply explained. Prior to its installation the loss on the sulphate plant, which had necessarily to be kept at work, was £500 a year; estimated on the working of the concentrated liquor plant during the past four months, this loss has been wiped off, and a profit is actually shown. The total gain to the Department is set down by the author as £578. Obviously a thoroughly sound move.

Unusual Difficulties

AN account is given on later pages of our issue to-day of how the Municipality of Bombay have brought their public lighting up-to-date—how they have introduced modern, efficient, and economical illumination without any material additional burden upon the taxpayer. At the present time, out of 216 miles of streets in the City, 140 are illuminated by gas, which, in spite of unusual difficulties, is proving itself thoroughly satisfactory from every point of view. The overcoming of these difficulties certainly reflects great credit on the Municipality and upon Mr. J. P. Blackmore, the Public Lighting Superintendent of the Bombay Gas Company, who is the author of the contribution. Modernization has been in the nature of a building-up process, the less important thoroughfares being dealt with first, and the saving thereby effected being employed to improve the more important roads. It will be noted that great improvement has been effected by increasing the height of the light source from the ground, a matter which was accomplished at very little extra cost. The equipment is such that as trade brightens so will the roads at night without any additional capital expenditure.

Owing to the peculiar circumstances imposed by a population of well over a million comprising Hindoos, Moslems, Christians, Parsees, and others who use sixty-two different languages or dialects, all lighting and extinguishing is done by hand. For his labours the lamplighter gets £2 5s. per month, and he has, of course, to keep his lamps in good order. A great deal of labour is needed to maintain a high standard of efficiency, due to the climatic conditions of Bombay. During the dry season there is the trouble of dust accumulation, and then in the wet season, which lasts three months and

during which more rain falls than England receives the whole year, there are even harder problems to face. For example, during the Monsoon of 1931, the rainfall in 24 hours was more than 20 in. Such heavy downpour is commonly accompanied by a high wind, and consequently the rain is driven horizontally against the hot glass panes of the lamps. Only the best heat resisting glass can be used, and even so many globes crack as though cut with a diamond. This trouble is not so bad, however, as what follows after the rain. Out comes the sunshine, and out come the insects. One very nasty specimen is semi fire-proof. This hard-coated bug is able to fly through a gas mantle several times before it succumbs to an unnatural death. And the author explains how in one such period he had to issue six months' stock of mantles in two days. Then the habits of the lamplighters have to be considered, for coconut oil, which is used for the torches, has been known to be adulterated, and steps have had to be taken to prevent the tea shops frequented by lamplighters being illuminated by mantles issued by the Gas Company. This problem was effectively overcome by issuing a size of mantle which fits none other than the special nozzles of the street lamps.

Again the population of Bombay does not always live amicably, and when communal riots do occur a popular and exciting pastime is to throw soda-water bottles at the street lamps. A small affair occurred this year, for example, which resulted in the death of eight persons and about fifty injured. The cause of the disturbance was that a Mahomedan was accidentally struck by a cricket ball hit by a Hindoo on a public recreation ground. During these times the public lighting is the most difficult, and at the same time one of the most important, of public services, without which the police and military would be considerably handicapped and the ruffian element encouraged. The transport arrangements which have to be made by the Public Lighting Department of the Bombay Gas Company during these periods of disturbance are interesting. Employees of the Department comprise 20 per cent. Christians, the remainder being an equal number of Hindoos and Mahomedans. It is not safe at such times for a Hindoo to approach a Mahomedan locality, and *vice versa*. The Hindoos and Mahomedans, therefore, are carefully separated and taken to their work in lorries and deposited at safe places such as Police posts. They then carry on with their lighting, return to the points of safety, and are picked up by the lorries and returned to their homes. Even these safeguards do not render the workmen immune from attack; but in spite of difficulties, public lighting has so far been carried on when most other public services have been at a standstill. Gas, in fact, never lets Bombay down.

Complete Gasification Up-to-Date

A STORY is told in the " JOURNAL " to-day of the satisfaction which has attended the operation of a modern Tully complete gasification plant at the Goring-on-Thames Works of the South Oxfordshire Water and Gas Company. The new plant there has many attractive features. Of a nominal capacity of 150,000 c.ft., it is capable of producing well in excess of this rating. The size was chosen by the Company so that the whole of the gas required could be made in one shift per day *and by one man*. Should there be a peak or abnormal load, the plant is merely worked an hour or so longer. The gas produced, of a calorific value of 365 B.Th.U. per c.ft., is fed into an intermediary relief holder, after passing through the usual washing and scrubbing apparatus. Thence, according to demand, it passes through oxide purifiers to the town holder and to the district.

We should have liked some figures of cost per therm into holder, and a reference to distribution costs; perhaps the Engineer and Manager, Mr. Geer, will supply these later. But, apart from this, we have the assurance that the plant is operating with complete success, and that its automatic working is such that the one attendant has ample time at his disposal for all general duties about the works and yard. The generator at Goring is fitted with an automatic poker in the retort section, which prevents " hanging up " and ensures that the coal is effectively coked before it reaches the gasification section. The grate of the generator is provided with an automatic rake for the continuous removal of ash and clinker; a waste-heat boiler produces the whole of the steam needed for gas-making and for driving the positive Roots blower and the operator engine. The mechanical operator is of especial interest. It is a simple, positive, foolproof device. An intermittently rotating shaft carries cams which open and close the valves in a predetermined sequence, one complete revolution of the shaft sufficing for one cycle of operation—blow, up-run, down-run, and purge. The duration of each period of the cycle is controlled by a selector gear which can be readily set to give the desired timing.

The major impression given by the contribution dealing with the Goring plant is that the peculiar merits of complete gasification for the small works cannot be ignored at the present day, when automatic trouble-free plant is available. At Goring all-Tully gas is sent out without enrichment or admixture of any kind and is giving an excellent performance for all purposes on the district; and our article to-day provides testimony that a similar state of affairs exists in other undertakings equipped with up-to-date complete gasification plants.

Very Ancillary Plant

IF published reports be true, certain of our motor-car manufacturers are proposing to provide wireless sets on the dashboards of their cars as standard. In the near future it will be more than ever true that " all the world's a stage." Our roads will be filled with cars each broadcasting the particular owner's preferred programmes, the while the cars move to the flashing lights of the traffic signals. Does this provision of wireless indicate that motor car manufacturers—spurred on by the endless demand for novelties—are finding it increasingly difficult to provide new features on next season's models? If so it is a provocative thought to anticipate what future specifications may provide us with. In the distribution of certain daily commodities, the gift schemes have developed on a national scale. We are accustomed to the incongruity of obtaining a wireless set while recovering from the effects of smoking too many cigarettes, but it is a new thought to obtain a wireless set by purchasing a motor car.

It is a fearsome thought to consider what would happen if the practice of providing such very ancillary equipment extended to our own Industry. The adjudication of contracts must exercise the minds of engineers sufficiently already, but their problems would be materially increased if in deciding between two tenders for carbonizing plant it had to be noted that one contractor offered to include a tar distillation plant, while another provided a free sulphate plant—the last-named being unnecessary because it was already included with the gasholder offer! Or again it might prove difficult to decide which of two offers for purifiers to accept when contractor A included for laying out the roof of the purifiers as a putting green, while contractor B had allowed for making the cellar beneath the purifiers into a swimming pool! Carrying this thought into the equipment section, gas undertakings might be expected to supply with each gas cooker a set of saucepans and with each gas fire a pair of carpet slippers. Absurd, you say. We entirely agree. But it is only by the method of *reductio ad absurdum* that present tendencies can be checked. We were recently offered a mangle if we managed to secure two or three subscribers for a well-known daily paper.

We sympathise with publicity methods as a means of securing business, but it seems to us that beyond a certain point the dignity and prestige of the selling organization may be affected adversely. We find it hard to believe that the general public really think that the present system of free gifts is an economical method of purchasing. The provision of unnecessary equipment on motor cars is a step in the direction of free gifts. It is to be hoped that our own Industry does not depart from its present policy of building success on the solid foundation of service, value and utility.

Correspondence

High-Pressure Gasholders.

SIR,—The 250,000 c.ft. holder at Skipton marks a step forward in the technical development of the Gas Industry in this country.

Having been closely connected as Consulting Engineer with the final, though not with the original, design of this structure, I think that it would be useful to draw attention to certain points in correct design which it is highly important should not be overlooked.

This vessel, measuring 102 ft. long by 32 ft. diameter, cannot be designed on the same lines as boiler tanks, which are often used as high-pressure gasholders, for the obvious reason that due to expansion and contraction—sometimes fairly rapid upon occasions when a hot sun succeeds heavy rain, or *vice versa*—a vessel 102 ft. long can conceivably lengthen or shorten by approximately $\frac{3}{4}$ in., while its circumference of 32 ft. can similarly vary by the same amount. A boiler tank 30 ft. long, on the other hand, is likely to expand and contract not more than about $\frac{1}{2}$ in. in length between the extremes of heat and cold, for which it is necessary to make provision in this country.

With a large vessel such as the Skipton high-pressure gasholder, it is essential, therefore, to provide for the whole structure to move freely circumferentially and longitudinally without disturbing its internal framework or the supports upon which it rests. Hence the rollers upon which the structure is supported, and a special design of internal framing which is the next point of importance. The object of the internal framework is to maintain the cylinder in its true concentric shape, whether it is or is not supported by an internal gas pressure; and consequently it should not be attached by bolts, rivets, or welded joint to the shell, but should be constructed of the same internal shape though slightly smaller than the shell, in order that the shell can support itself on the internal framework, but with freedom to move in any direction without being held in one rigid position by the framework.

These precautions were in the early days neglected in certain cases in the United States, where there are many high-pressure holders of similar size to that at Skipton, with the result that the vessels developed numerous small leaks.

I take no credit for doing more than passing on the results of the experience of my friends, Messrs. Stacey Brothers, of Cincinnati, who, with the kindness and generosity typical of American gas people gave me freely of their extensive knowledge on this question of the correct design and construction of large high-pressure gasholders. It proved useful in the case of the Skipton holder, and it is well that we should acknowledge with gratitude any help which we receive from gas engineering friends in other countries.

Yours, &c.,
G. M. GILL.

82, *Victoria Street,*
Westminster, S.W. 1,
Sept. 15, 1933.

Organizing for Selling.

SIR,—The continuing increase in the use of electricity is naturally a matter of concern to those engaged or interested in the supply of gas. The Gas Industry generally has responded to the electrical challenge by devoting greater attention to the selling of gas, and the success that has attended their efforts affords definite proof that there is a large and yet unsatisfied demand for gas for all domestic services.

In support of this statement, the experience of an undertaking supplying $\frac{1}{20}$ of the total output of the country may be quoted. During the last ten years over 36,000 appliances of a value of £240,000 have been sold either for cash or on hire purchase, and the annual sales have increased progressively during this period.

If this result may be taken as typical of the remainder of the country, it would appear that over one million gas appliances are purchased annually at a cost of over seven million pounds.

The results of the Undertaking referred to have been achieved by the activities of an ever-growing sales organization.

Yours, &c.,
"ENGINEER."

Sept. 12, 1933.

PERSONAL

The marriage of Mr. MAURICE H. THORNTON, son of Mr. H. M. Thornton, J.P., and Mrs. Thornton, and Miss Murielle Godfrey, took place at the Congregational Church, Purley, on Sept. 15. Some two hundred guests attended the ceremony. A reception was afterwards held at the Selsdon Park Hotel.

OBITUARY

Mr. ALFRED WILLIAM EDWARDS died on Aug. 19 in his 76th year. He served the Danish Gas Company for 58 years, becoming successively Manager of the Frederiksberg Works in 1887, Chief Engineer in 1903, when he succeeded the late Mr. F. D. Marshall, General Manager in 1913, and a member of the Board in 1918, when it was necessary under the Danish Law to constitute a Board in Denmark. From that date he occupied the position of Chairman. Deceased was the son of Mr. Samuel Edwards, who was the Company's Chief Engineer from 1859 to 1881.

* * *

The death occurred on Sept. 11 of Mr. WILLIAM W. TOPLEY, F.C.I.S., for many years Secretary of the Croydon Gas Company. Mr. Topley was born in the year 1868, and entered the service of the Croydon Gas Company in 1898, being appointed Secretary in 1902, prior to which he had acted in the capacity of Assistant Secretary. He retired at the end of June, 1926. Mr. Topley's body was cremated at the Golders Green Cemetery on Sept. 14, and the Croydon Company were represented by the General Manager (Mr. W. J. Sandeman) and the Secretary (Mr. F. F. Wood).

* * *

The death took place on Sept. 11, as a result of heart failure following influenza, of M. HUBERT DE LE PAULLE, for many years Manager of the Brussels Station of the Imperial Continental Gas Association. At the time of his death M. de le Paulle was President of the Belgian Gas Association.

BOOK REVIEW

ENERGY PRINCIPLES IN THE TECHNOLOGY OF GASES.*

The book deals with the energy principles involved in the treatment of gases and with the kinetics of gaseous reactions. An introductory section is devoted to fundamental principles and includes a discussion of the conception and implication of temperature, pressure, dew-point, energy, entropy, chemical equilibrium, reaction velocity, heat of reaction, &c.

In the next section, the heating and cooling of gases is first dealt with, then evaporation, condensation, absorption, and adsorption. Chemical reactions in which gases are formed or take part are then treated. This section contains much matter pertaining to the fuel industries and discusses, for example, calorific value and its calculation, combustion diagrams, heat flow diagrams, flame temperature, velocity of flame propagation, and explosive limits. Thermal balances for carbonization, producer gas manufacture, and water gas manufacture are worked out in great detail, and, indeed, it is a useful feature of the book that a large number of lengthy calculations are fully explained with the help of examples covering a wide variety of technically important processes.

Then follows a chapter devoted to the use of mechanical energy in the treatment of gases. This deals with the compression and liquefaction of gases, with reactions occurring under pressure, and with the removal of suspended matter from gases.

The final chapter is devoted to electrical and electrolytic processes and to electrostatic precipitation.

In addition to data which are scattered throughout the book, there is an appendix which includes a number of useful tables.

It was by no means an easy task for the author to handle so many themes in a book of slender dimensions. He has, however, achieved his object very successfully, and the volume may be recommended as a useful introduction to more specialized treatises.

* Energetische Grundlagen der Gastechnik. By F. Schuster. [Volume 30 of the Series Kohle-Koks-Teer.] [Halle (Saale), 1933, Wilhelm Knapp. Pp. VIII. + 254. Price RM. 17 unbound, RM. 18·50 bound.]

THE NEWS OF THE WEEK

At a Meeting of the Town Council held in Renfrew on Sept. 11 it was decided to reduce the price of gas from 3s. 1½d. to 3s. per 1000 c.ft.

Increased Output at Kilmarnock.—The output of the Kilmarnock Corporation Gas Department for the year ended May, 1933, was 326,008,275 c.ft., being an increase of 1,653,030 c.ft. over the previous year.

The 1933 Edition of the Education Regulations of the Institution of Gas Engineers, which takes the place of all previous issues, has been published, and copies may be obtained from the Secretary of the Institution, 28, Grosvenor Gardens, London, S.W. 1.

Dunfermline Town Council has had a joint meeting with Fife County Council and discussed a proposal that Dunfermline Town Council should take over Tulliallan Gas-Works. The Burgh Gas Manager has been instructed to make a survey of the works.

North of England Association.—The Autumn Meeting of the North of England Gas Managers' Association will be held at South Shields on Friday, Oct. 6, at 2 p.m., when the President, Mr. A. Pickering, of South Shields, will deliver his Presidential Address.

We Understand that Negotiations which have been taking place for some considerable time have now been completed, whereby the shares held by International Combustion Engineering Corporation of New York, in International Combustion, Ltd., of Aldwych House, Aldwych, W.C. 2, have been acquired by English interests. No shares are now held in the United States of America.

The Following New Scale of Charges has been adopted by the Malvern (Worcs.) Urban District Council in respect of the Gas Undertaking: 9½d. per therm through ordinary meters, 10d. per therm through prepayment meters without free cooker, 10·5264d. with free "unpacked" cooker, and 11·112d. with free "packed" cooker within the Urban District, and 12·5d. per therm outside the urban district.

Gas Lighting Retained at Moretonhampstead.—When the Moretonhampstead Parish Council met on Sept. 5, the Lighting Committee reported that the terms offered by the Gas Company for public lighting were better than those offered by the Torquay electricity undertaking, and that a continuation of gas lighting would mean the saving of a considerable amount of money to the ratepayers. It was therefore decided to enter into a contract for public lighting by gas for a period of another five years.

That Edinburgh Gas Supplies are quite up to the standard laid down by the Gas Regulation Act is borne out by the following extract from the Gas Examiner's report to Mr. James Jamieson, Engineer and Manager of the Corporation Gas Department. The extract reads: "According to the Gas Examiner's report for the past quarter, the calorific value of gas supplied throughout the area of the city and suburbs, was 475·7 B.Th.U. per c.ft. It was free from impurity, and the pressure tests throughout the area were also satisfactory." The declared calorific value of Edinburgh's gas is 475 B.Th.U.

The Scheme for Manufacturing Gas for distribution to tomato growers in the area at Woodside Colliery, Lanarkshire, was referred to at the last meeting of the Gas Committee of Lanark County Council. The proposed Company (the Clyde Valley Gas Supply Company), it was divulged, is to be sponsored by MacLaurin Coal Products, Ltd., 19, St. Vincent Street, Glasgow. MacLaurin plant will be installed and smokeless fuel will be produced. Gas will be supplied to fruit growers in the area at 2d. to 2½d. per therm. They also propose to apply for powers to supply gas generally in areas not supplied by the County Council.

Cheaper Gas for Dunbar.—On the recommendation of the Gas Committee, the Dunbar Town Council have approved of the price of gas being reduced by 10d. per 1000 c.ft., which will mean that the price, as from the ensuing quarter, will be fixed at 3s. 9d. per 1000 c.ft., this being back to the pre-war level. At the monthly meeting, Councillor Chapman said that the Gas Manager (Mr. George Urquhart) and the Gas Commissioners, were deserving of thanks for the admirable manner in which they had conducted the works during the past year, thus bringing about this reduction in price which would give much satisfaction to all consumers.

A Falling Off in Gas Sales was revealed in the Half-Yearly Report of the Directors of the Maryborough Gas and Coke Company (Queensland) for the half-year ended June 30 last, but residual products showed an increase, due to more tar sales. Expenditure shows a reduction as compared with 1932. The sum of £412 was transferred from reserve fund to the credit of profit and loss account. After writing off £300 for depreciation, transferring £412 to reserve fund, and making provision for all other charges, the profits amounted to £921. To this amount was added £110 brought forward from last half-year, making the total amount at the credit of profit and loss account £1031. The Directors recommended payment of a dividend of 5% per annum.

Staff Kitchen "Magic."—One of the greatest problems confronting big stores, manufacturers, and businesses is that of catering for their large staffs. The latest issue of "A Thousand-and-One Uses for Gas," published by the British Commercial Gas Association, deals fully with this question of the staff canteen and illustrates the equipment and lay-out of the most modern examples. Messrs. Harrods' kitchen (to take one instance) serves no fewer than 14,000 meals a day. Enamel and stainless steel is used for all their latest gas cooking apparatus. Among the other kitchens illustrated and described are those of the Prudential Insurance Company, the Royal London Mutual Insurance Company, the Royal Arsenal Co-operative Society, "Ovaltine," and Morris Motors.

Manchester District Association.

The Annual Luncheon of the Manchester District Association of Gas Engineers will be held at the Midland Hotel, Manchester, on Friday, Oct. 27, when Certificates will be presented to successful students in the recent examinations of the Institution of Gas Engineers.

At 2.30 p.m. the October General Meeting will take place, when Mr. A. L. Holton, Chief Engineer to the Manchester Corporation Gas Department, will read a paper entitled "The Treatment and Partial Distillation of Tar by Hot Crude Gases."

Yatton Street Lighting.

The gas versus electricity controversy in regard to the street lighting in Yatton was the subject of further discussion at a recent monthly meeting of Yatton Parish Council.

At its previous meeting the Council accepted the Yatton Gas Company's tender of £95 for lighting during the coming winter.

Mr. E. W. Tole, Secretary to the North Somerset Electric Supply Company, now wrote: "May I ask you to get your Council to consider the question of altering the street lamp positions which, if done, we are sure would make a much better lighting scheme than at present. You might even consider the question of more modern lighting in the shape of central suspended lamps, and we say, with all due respect to your Council, that to stick to the old conditions which have obtained for a good many years in the past is not in the true interests of the users of the Yatton streets.

THE NEWS—*continued.*

We shall be glad to hear whether the public lighting contract has yet been settled, and if so at what figure."

The Chairman (Mr. B. Crossman) said he thought the North Somerset Supply Company wanted to commandeer too much.

Mr. T. Burdge, C.C.: I suggest that the letter lie on the table or be put into the wastepaper basket.

Mr. H. Gard supported, and the Council resolved to take no action.

Dramatic Cookery Demonstrations.

A novel form of cookery demonstration is being introduced by the Parkinson Stove Company, Ltd. The first demonstrations are being held at St. Peter's Hall, Bournemouth, during the present week.

These demonstrations can be best described as a series of cookery demonstrations dramatized or given in the form of simple plays, illustrating home life and methods of cookery and housekeeping—an indirect method of advertising gas appliances, and, in particular, gas service.

The demonstrations are being produced by Miss Gwen L. Hughes, Diplomée, Melbourne School of Domestic Economy, who has been most successful with this type of demonstration in Australia. At Bournemouth there are six evening performances and two matinees during the week, and it is the intention of the Parkinson Stove Company to stage a different demonstration at each session.

Works, Roads, and Transport Congress.

The Seventh Public Works, Roads, and Transport Congress and Exhibition will be held at the Royal Agricultural Hall, London, N. 1, from Nov. 13-18. The Exhibition will comprise all types of machinery, plant, and materials required in connection with the activities of public authorities and approximately 76,000 sq. ft. of space have been applied for and allotted.

A Session will be devoted to the Gas Industry on Tuesday, Nov. 14, at 11 a.m., when the following two Papers will be presented and discussed:

> "Dry Purification; Some New Methods for its Control," by W. A. Currie, Technical Assistant, Provan Works of the Glasgow Corporation Gas Department.
>
> "Qualities of Tars for Use on Roads," by W. E. Cone, Technical Adviser, British Road Tar Association.

The Session is held under the auspices of the Institution of Gas Engineers, and the chair will be occupied by the President of the Institution, Mr. Frank P. Tarratt, a Vice-President of the Congress and Exhibition.

In addition, a Joint Session of the Institution of Gas Engineers and the Association of Public Lighting Engineers will be held on Nov. 14, at 3 p.m., at which a paper on "Some Notes on the Lighting of Arterial Roads by Gas" will be presented by Mr. A. M. Bell, Public Lighting Superintendent, Tottenham and District Gas Company. The President of the Association of Public Lighting Engineers, Mr. E. M. Severn, will be in the Chair.

Sessions are also devoted, *inter alia*, to sewerage, water supply, the construction and maintenance of roads and bridges, electricity supply, and town building.

A Papers Competition is held in connection with each biennial Congress and Exhibition, and thirty-nine papers were submitted for the 1933 Competition. The prizes awarded (to be presented at 2.30 p.m. on Wednesday, Nov. 15), consist of a Gold Medal and one hundred guineas, a Silver Medal and fifty guineas, a Bronze Medal and twenty guineas, a Fourth Prize of ten guineas, and in addition there are nine awards of five guineas each for other competition papers accepted for presentation, one of which was awarded to Mr. W. A. Currie for his paper to be presented at the Session of the Institution of Gas Engineers.

Delegates to the Congress and Exhibition pay a fee of one guinea, which includes advance copies of all papers to be read, entrance fee, exhibition catalogue, and the bound volume containing the official report of the Congress proceedings. The Secretary of the Institution is in a position to arrange for the complimentary admission of a limited number of members not registered as delegates, but tickets issued for this purpose do not entitle the holder to the publications aforementioned, although the holders may participate in the discussions.

The Minister of Health will consider applications for the sanction of the payment by Local Authorities of the reasonable expenses incurred in connection with the attendance of not more than two delegates from local authorities whose accounts are subject to District Audit and who have sufficient grounds for wishing to be represented at the Congress. The Railway Companies in Great Britain will issue return tickets to London at a single fare and one third on presentation of the appropriate voucher.

The Institution of Gas Engineers is represented on the Permanent Organizing Committee of the Public Works, Roads, and Transport Congress and Exhibition by Mr. John Terrace, Past-President, and Mr. J. R. W. Alexander, Secretary, to whom requests for invitations and for further information concerning the Congress and Exhibition may conveniently be addressed by members of the Gas Industry. The address of the Institution is 28, Grosvenor Gardens, London, S.W. 1.

Pushing the Automatic Water Heater.

Bristol's Live Campaign.

A new solution to an old problem is the slogan adopted by the Bristol Gas Company to focus attention on a recently organized water heating campaign. The Company believe there is a big field in their area for the smaller type of automatic water heater, and are certainly going all out to get it.

The campaign was timed to commence with the opening of the Twelfth Annual Bristol Exhibition, held from Aug. 31 to Sept 13. The Company have always played a prominent

Striking Water Heater Display at Bristol.

part in this event, and on this occasion made water heating a feature of their display.

In the centre of the building, on an island stand, marked by its very simplicity, a comprehensive array of water heaters was shown under working conditions. This live exhibit proved a source of considerable interest, particularly to ladies.

During the Cookery Lectures, held in conjunction with the Exhibition, the Company's Lady Demonstrator, gave short talks on automatic water heaters. Publicity during the whole of September is being concentrated on water heating.

Special displays have been arranged in the showrooms, and these have been augmented by the use of temporary premises in a prominent shopping centre. Ironmongers and plumbers have been induced to display heaters, and a commission is allowed them on all orders obtained from consumers recommended by them. Much good work has also been accomplished by a technical representative of the Company in bringing to the notice of architects the more recent types of gas water heater.

Poster space has been taken on hoardings, and the Company's transport utilized for the display of placards. The local Press have generously assisted the campaign by publishing free articles dealing with gas for water heating. The Bristol Gas Company have long made use of Press advertising.

Letters are being posted to consumers pointing out the advantages of automatic water heaters, and the easy terms on which they may be obtained. Each letter is in due course followed up by specially selected salesmen. For three months these men have been perfecting their knowledge of water heating apparatus, and part of their train-

ing consisted of a fortnight in the appliance manufacturer's workshops. Each salesman carries with him a case containing two small models of an appliance.

All employees have been informed of the campaign and encouraged to make it known to the general public. Collectors and inspectors carry a supply of suitable literature, while no correspondence leaves the office without a water heater folder as an enclosure.

The Bristol Gas Company, from the Directors to the page-boy, are meantime living in an atmosphere of water heating.

Gas Continues to Light South Molton Streets.

A letter from the Exe Valley Electricity Company, Exeter, inquiring whether the authority would be prepared to consider a tender submitted by them for the public lighting of the Borough for a definite period of years, was considered at a meeting of the South Molton Town Council on Sept. 12.

Alderman M. Clarke said it would be foolish to entertain the application from the electricity company, and moved a resolution to that effect. In the course of the discussion it was pointed out that the gas undertaking had several times handed over a surplus towards the relief of the rates, and that it would be folly for the Council to pay away £360 a year to an outside firm for public lighting when they had their own gas undertaking.

By eight votes to four it was decided to decline the offer.

Diesel Locomotive Runs on British Coal-Oil.

Following exhaustive tests, which were completed at the Shipping and Engineering Exhibition at Olympia on Sept. 15, the new Armstrong Whitworth Diesel-electric shunting locomotive being demonstrated there is now being run on oil produced from British coal. This is the first time that a standard railway Diesel-electric locomotive has used coal-oil as its motive power. The coal-oil was produced from ordinary coal mined in Lancashire and Yorkshire.

"We have been experimenting with British coal-oil for some months," stated an Armstrong Whitworth official at the Exhibition, "and are very gratified in being able to use such fuel in our standard engines. The use of coal-oil by Diesel-electric railway units opens up an important new outlet for British coal products. If, for example, the main line railways were Diesel-electrified, not only would the companies effect savings of £25,000,000 a year in working costs compared with steam, but the miners would have to supply some 7,000,000 tons more coal than is now consumed by the railways, to produce the oil that would be required. We are watching the development of the coal-oil industry with the greatest interest."

THE NEWS—continued.

Liverpool All-Gas House.

Exhibition houses built and equipped by a number of tradesmen working co-operatively, have proved to be a useful means not only of selling houses, furniture, and equipment, but of popularizing gas as a medium of light and heat.

In the all-gas exhibition house in Hampton Court Road, West Derby, Liverpool, which was opened by the Lady Mayoress of Liverpool on Sept. 14, the Liverpool Gas Company supplied all the fittings and appliances and made this house a miniature exhibition of the latest and best gas equipment.

Instruction in Metallurgy.

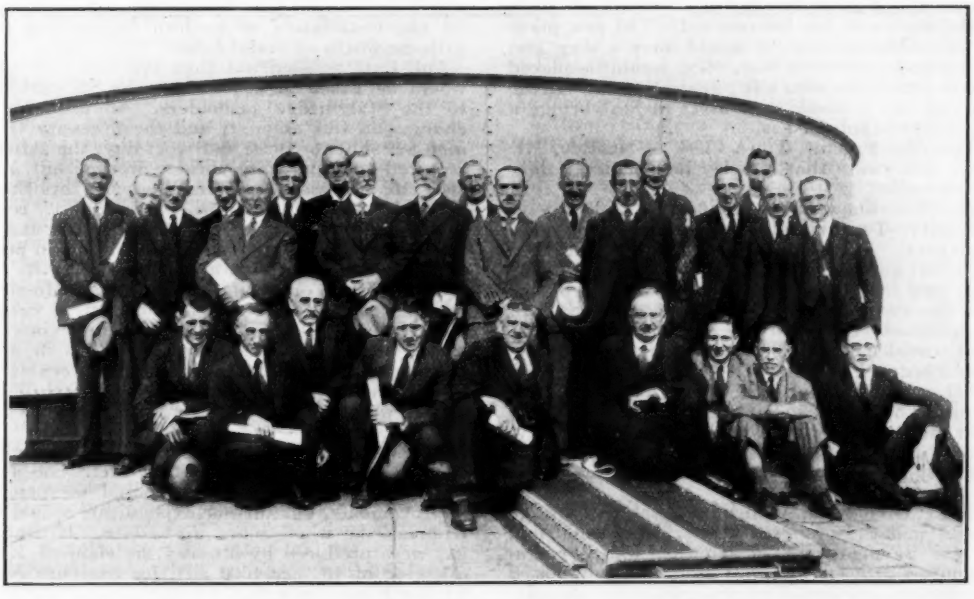
Modern metallurgy has made valuable contributions to the social and industrial life of civilized nations, and in this connection mention may be made of stainless steel, alloy steels for aero and other internal combustion engines, and aluminium alloys for aircraft, all of which have resulted from metallurgical research.

A corresponding development in education in all branches of metallurgy has also taken place, and with a view to directing attention to the facilities which are available for instruction in this subject, the Sir John Cass Technical Institute have published a booklet entitled "Modern Metallurgy," which gives some idea of the up-to-date character of the Institute's present equipment. This equipment, we understand, will be considerably augmented when the accommodation is increased by the extension which is now in progress, and which will be available for use in a few months' time.

Those associated with or interested in the many branches of metallurgy, including applications to gas supply and gas engineering, fuel, and refractories, will find in the pages of this booklet a summary of courses in these and allied subjects suited to their requirements. A series of excellent photographs shows the extensive laboratories and apparatus available at the Institute, of which the following may be cited: Metallurgical analysis, assay laboratory, and furnace room; mechanical testing laboratory; metallography and pyrometry laboratory; together with foundry and heat treatment plant.

Students may enrol for any class provided they possess sufficient knowledge of fundamental sciences to benefit by attendance at the class in question. Instruction is also given in the methods of original research to meet the requirements of those desiring to become candidates for higher degrees of London University, or to carry out individual investigations. Further information may be obtained upon application to the Institute, Jewry Street, Aldgate, E.C. 3.

New Waterless Holder at St. Helens



This photograph was taken on the top of the new waterless holder at St. Helens, which, as recorded in the "JOURNAL" last week, was officially inaugurated on Sept. 6.

THE NEWS—continued.

Institute of Fuel.

October Meetings in London.

On Wednesday, Oct. 11, the opening meeting of the session of the Institute of Fuel will be held in the Lecture Theatre of the Geological Society of London, Burlington House, Piccadilly, W. 1, at 5.30 p.m., when Sir John Cadman, G.C.M.G., the Melchett Medallist for the current year, will deliver the Melchett Lecture, his subject being "The Place of Oil in the World of Fuel." Sir Hugo Hirst will take the Chair at this lecture. The Melchett Medal will be presented to Sir John at the Annual Dinner of the Institute, which is to be held on Oct. 18.

Sir Hugo Hirst, Bt., who has served the Institute as President for the past two years, will relinquish his office on Oct. 18 and install the President-Elect, Sir William J. Larke, K.B.E., in his stead. This ceremony will take place at 11.30 a.m., in the Lecture Theatre of the Geological Society of London, and will be followed immediately by Sir William delivering his Presidential Address.

A meeting has however been arranged to be held at 2.30 p.m., in the same room, at which Dr. E. W. Smith will open a discussion on "Recent Developments in Coking Practice," to be followed by Dr. G. E. Foxwell and others. The most recent developments of both high and low temperature coking practice will be dealt with by the openers of this discussion.

Alleged River Pollution by Gas-Works.

Town Council Sued.

Reference was made at a meeting of the South Molton Town Council on Tuesday, Sept. 12, to the issuing of a writ against the Council by Mr. A. B. Bramwell, in regard to the alleged pollution of the River Mole by effluent from the gas-works.

The Town Clerk had explained the position fully, it was stated, and expressed his regret that the Council had not accepted his advice to settle the matter in the first instance on the terms offered by the plaintiff. He now advised the Council not to contest the action, but to compromise, with a view to a settlement.

By twelve votes to two the Council decided to accept the advice of the Town Clerk, who was instructed to compromise on the matter, without prejudice, upon the terms he had suggested.

Ministry of Health Inquiry at Stalybridge

Mossley's Offer to Supply Gas

An inquiry has been held into the application of the Stalybridge Corporation to borrow £18,000 for renewal of carbonizing plant at the Gas-Works.

The inquiry was conducted by Mr. G. Carlyle, M.C., Assoc.M.Inst.C.E., and Stalybridge's case was put by the Town Clerk (Mr. F. H. Worsley), supported by Mr. R. J. Restall, the Gas Engineer, and Col. W. M. Carr, of Stretford.

Mossley, having been informed by the Ministry of Health that they might attend the inquiry, were represented by Mr. V. C. Proctor (Town Clerk), supported by Mr. W. Bennett, Gas Manager, Mr. G. Evetts, Consulting Engineer, and Mr. W. B. McLusky, of Halifax.

The Town Clerk of Stalybridge, said that the proposed alterations at the gas-works would mean a reduction in gas charges. The present carbonization plant was installed in 1896, and re-modelled in 1913. The plant was workable, but very uneconomical. The charge for gas was 4s. down to 3s. 5d. per 1000 c.ft., or 9·6d. down to 8·2d. per therm. Under the new system, charges would be reduced by 5d. per 1000 c.ft., or 1d. per therm.

Mr. R. J. Restall said that when he was appointed in 1932 the renewal of the carbonization plant was under consideration, and he was asked to prepare a report. The old plant was fairly efficient, but the production costs were heavy, and the time was due for renewal. The new plant would be comfortable to work, it would have a long life, and its maintenance costs were low. Gas would be placed in the holder at 7·82d. per 1000 c.ft., against 15·3d. If the work was carried out it would give users in Stalybridge a cheap and excellent supply of gas.

Questioned by Mr. Proctor, Town Clerk of Mossley, Mr. Restall said he was aware that Mossley had made an offer to supply gas in bulk.

Mr. Proctor: You know of no engineering difficulty in carrying that out?—I would rather not answer that question at the moment.

Col. W. M. Carr, questioned by Mr. Bennett, the Mossley Gas Engineer, said that if gas was supplied to Stalybridge in bulk at 1s. per 1000 c.ft., it would cost 4·2d. more than it could be produced at Stalybridge. The installation of the new plant would mean that the price of gas in Stalybridge would be reduced by 3¾d. per 1000 c.ft.

Questioned by Mr. Proctor concerning the ability of Mossley to supply Stalybridge, Mr. Carr said that if they were going to link up the whole supply as between Stalybridge, Ashton, Mossley, and Dukinfield, obviously the cheapest and best place to develop that supply was Stalybridge.

Alderman J. W. Greenwood, Chairman of the Stalybridge Gas Committee, said the proposed new scheme would find employment for 24 men for ten months, while several thousand pounds worth of material would be purchased locally. In addition, gas would be produced more cheaply, and this would tend to induce new industries to come to the district.

Mr. W. Bennett said the new works were erected at Mossley when it was decided that the old works, erected in 1862, were becoming obsolete. The Mossley Corporation had made a definite offer to supply gas in bulk into the mains of the Stalybridge Corporation at 1s. per 1000 c.ft., on an agreement for a term of years. The plant at Mossley was quite capable of supplying both districts and having a reasonable reserve. It was proposed to supply the gas through a 6-in. high-pressure main.

Mr. A. Lancashire, Clerk to the Saddleworth Urban District Council, said that Saddleworth Council had been assured by Mossley that the greater output of gas would be of benefit to consumers in Mossley and Saddleworth. He was instructed to say that Saddleworth would welcome any scheme which would result in the gas output of Mossley being increased, on the understanding that the increased output would reduce the price of gas to the present consumers.

Col. Carr, recalled, said the saving effected by any scheme of amalgamation would be very small. The only disadvantage of the Stalybridge Works was that they were some distance from the railway, but even so, it cost less to transport coal to Stalybridge than to Micklehurst sidings. "I submit," he added, "that the purchase of gas in bulk does not offer to the gas consumer in Stalybridge any possible advantage over and above the present working, and I also submit that there would be a decided advantage by the installation of modern carbonizing plant at the existing works at Stalybridge."

Col. Carr pointed out that the cost of running a main would be £4000 to £5000 from the Stalybridge Boundary to the Stalybridge gasholders. Allowing for the capital charges on this amount, and the necessity to employ one man per shift for three shifts per day, the actual cost of gas required to supply Stalybridge worked out at 12.83d. per 1000 c.ft. It was stated that the price into the Stalybridge gasholders would be 14·57d. per 1000 c.ft., compared with 14·9d. per 1000 c.ft. for the year 1931-32, and that, therefore, there was no appreciable advantage in purchasing gas at the Boundary in bulk at 12d. per 1000 c.ft.

Mr. Evetts, Consulting Engineer, said Mossley's proposal was perfectly sound. Their works were capable of providing the supply, and if the contract could be made it would tend to reduce the price of gas in Mossley. The figures put forward by Stalybridge concerning the working of the new plant, represented an extremely high standard, and it was doubtful whether they could keep up to it in practice.

Mr. McLusky, Gas Engineer to the Borough of Halifax, said the Stalybridge Gas-Works were not as efficient as those at Mossley. It was proposed to spend £18,000 on improvements, but further expenditure would be necessary to bring the whole plant up-to-date. If the whole of the gas were produced by Mossley, he claimed, it would mean a saving of 4d. per 1000 c.ft. for Stalybridge people, and 1d. for Mossley people.

The inquiry was closed, and later visits were paid by the Inspector to the Stalybridge Gas-Works, and also to the Mossley Gas-Works.

THE NEWS—*continued.*

Gas-Works to Sell its Waste Heat.

Manchester Greenhouse-Heating Scheme.

The Manchester Corporation Gas Committee has approved, subject to the approval of the City Council, of a scheme for the sale of its waste heat and hot water to a Company about to be formed to develop a six acre plot which is to be covered with greenhouses, for the production of tomatoes and early lettuce. The land adjoins the Manchester Gas-Works.

Approximately 12,000 to 15,000 gallons of water per hour are used at the gas-works for cooling purposes, and the plan for utilizing the water in the houses and returning it to the gas-works, has been devised by a technical expert. It is computed that about 300 tons of tomatoes may be grown annually and a corresponding quantity of lettuce.

The City Council, it is stated, is not likely to turn down the recommendation of the Gas Committee, as that Department will benefit to the extent of about £500 per annum.

Street Lighting in Manchester.

More Automatic Controllers in Use.

The quantity of gas used for Street Lighting Purposes in Manchester has been reduced from 677 million c.ft. for the year ended March, 1932, to 660 million c.ft. for the year ended March, 1933, states the City Engineer in his annual report. There has also been a drop in the consumption of electric current.

Following an inquiry into the system of high-pressure gas lighting, arrangements were made with the Gas Committee to improve the system. The net result was a reduction in the cost to the Highways Committee of over £5000 per annum. The Highways Committee promises to reconsider this form of lighting at a later date.

The number of automatic controllers used for lighting and extinguishing gas lamps has been increased by 127 to 492, and tests now being carried out on one with a flashing by-pass, indicate the probability of a considerable saving in the quantity of gas used for this purpose.

National Gas Council

Meeting of Central Executive Board

A Meeting of the Central Executive Board of the National Gas Council was held at 28, Grosvenor Gardens, S.W. 1, on Tuesday, Sept. 12. In the absence of Sir David Milne-Watson, the chair was taken by Major G. H. Kitson.

Slum Clearance Schemes.—The Board considered the Report of the Departmental Committee on Housing which was appointed by the Government on March 6 and presided over by Lord Moyne, to consider, *inter alia*, what further steps were desirable to " secure the maintenance of a proper standard of fitness for human habitation in working-class houses " which are not dealt with under the Housing Acts.

It appears that there are a large number of deteriorating dwellings not falling within the category of slum property, which cannot, therefore, adequately be dealt with by local authorities. The Committee suggests that property of this character should be acquired by approved Public Utility Societies by means of money advanced by the Treasury. It is estimated that the National Housing Campaign would affect a total of one million houses including those covered by the Report.

Consideration was given to the steps which had already been taken and which it was proposed to pursue, in order to ensure that the facilities which the use of gas offered should be considered in connection with this re-housing scheme.

It was reported that at the inquiry by the Ministry of Health in connection with the scheme proposed by the Yarmouth Town Council representations were made on behalf of the Great Yarmouth Gas Company and the Gorleston and Southtown Gas Company, when it was pointed out that the question of compensation was not within the jurisdiction of the Ministry of Health Inspector, but that, if the Order were granted, claims for compensation would be made before the Arbitrator appointed under the Acquisition of Land (Assessment of Compensation) Act, 1919. It was urged on behalf of these Gas Companies that the Minister might not make the Order unless the Corporation gave an undertaking not to impose restrictions regarding the use of gas upon tenants who might become occupiers of premises erected by the Corporation in substitution for the demolished slums, and furthermore, that equal facilities would be given to the Electricity Department and to the Gas Companies for making provision for heating, lighting, and cooking in such premises.

It was reported that the result of the Inquiry had not yet been published.

Tredegar and Electricity.—It was reported that representations had been received objecting to a statement made by the Inspector conducting an inquiry at Tredegar on behalf of the Electricity Commissioners. The Board, in upholding these protests, gave instructions that the attention of the Government Department responsible should be drawn to the position.

Mains and Cables in Highways.—It was reported that a meeting of the Negotiating Committee had been held in the early part of August, when an agreement had been reached between the representatives of Highway Authorities and Gas and Electricity Undertakings, and that a clause embodying this agreement was in course of preparation.

Gas for Motor Vehicles.—It was reported that The Motor Vehicles (Compressed Gas Propulsion) Provisional Regulations, 1933, had been submitted by the Ministry of Transport in draft form and had been considered by the Joint Committee on compressed gas as motor fuel. Several amendments had been submitted by the National Gas Council practically all of which had been accepted by the Ministry.

The Compressed Gas Cylinders (Fuel for Motor Vehicles) Conveyance Regulations, 1933, had been made by the Home Office. Although they were regarded as somewhat stringent it was noted that the Secretary of State was empowered to make such modifications as experience might show to be desirable.

It was reported that the attention of the Council had been drawn to certain statements appearing in the Press from which it would appear that the Bye-laws and Regulations which the Mersey Tunnel Joint Committee were proposing governing the use of the tunnel, might automatically preclude vehicles using compressed gas as fuel from entering the tunnel. The Council had thereupon communicated with the Mersey Tunnel Joint Committee, with a view to satisfying the Committee that such vehicles would not cause danger or inconvenience to others using the tunnel.

Coal Hydrogenation Processes.—Consideration was given to the guarantee given by the Government in connection with home produced oils, and its possible effect upon the Gas Industry.

World Power Conference (Chemical Engineering Conference).—It was reported that Sir David Milne-Watson had agreed to act as Chairman of the Organizing Committee, and Mr. E. J. Fottrell, the Joint Manager of the Council, was appointed to represent the National Gas Council on the Grand Council of this Body.

British Industries Fair, 1934.—A Resolution from the Joint Gas Conference Committee, expressing the opinion that a Conference should be held in 1934, was approved, and the following representatives were unanimously reappointed to act on behalf of the National Gas Council: Mr. P. N. Langford, Mr. W. W. Townsend, and Mr. H. C. Smith.

Irish District Executive Board.—The resignation of Mr. H. W. Saville as Hon. Secretary of the Irish District Executive Board was reported, and the Board passed a Resolution expressing their appreciation and thanks to Mr. Saville for the work which he had accomplished in that capacity, and for the efforts which he had made for the advancement of the work of the Council.

It was further reported that the Board had unanimously appointed Mr. F. J. Edmonds, the Manager of the City of Waterford Gas Company, as Hon. Secretary.

International Gas Conference and Fifteenth Annual Convention of the American Gas Association.—It was reported that Mr. F. P. Tarratt, Col. W. M. Carr, and Mr. W. J. Grey had kindly promised to represent the National Gas Council at the Conference in America.

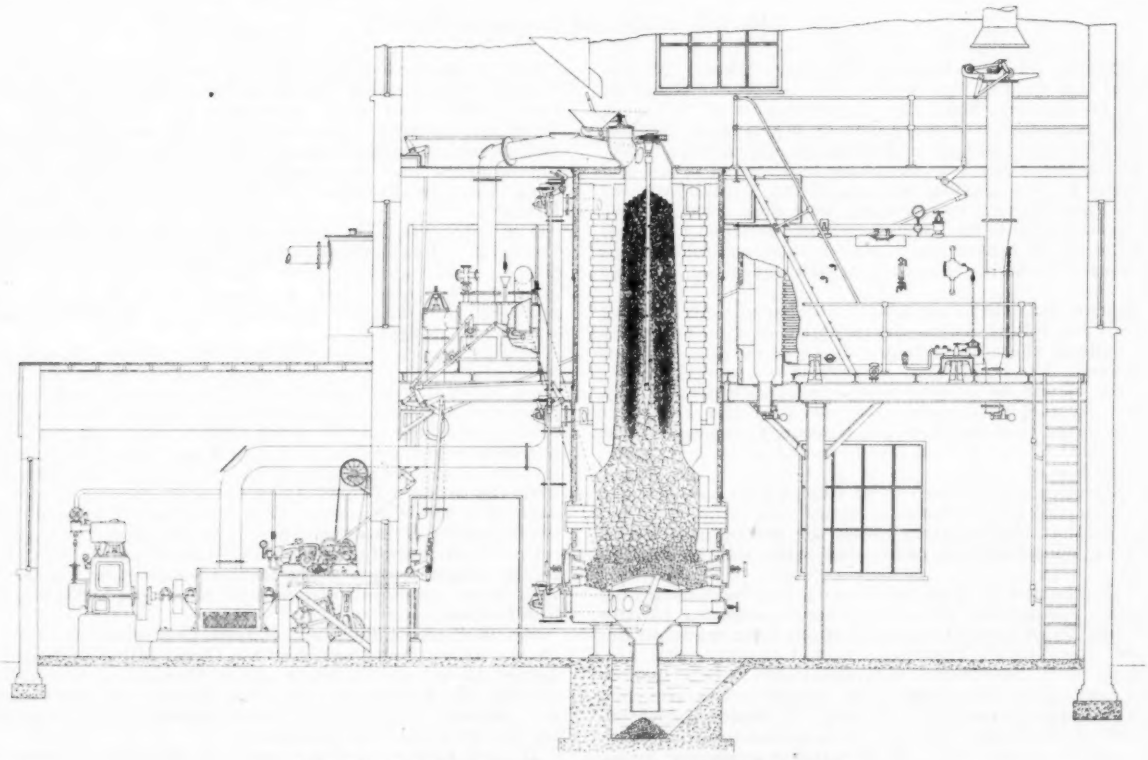
Central Gas Advisory Board.—The following representatives were unanimously re-nominated to serve as Members of this Board on behalf of the National Gas Council for the ensuing year: Mr. Stephen Lacey, Mr. J. W. McLusky, Mr. C. S. Shapley, and Mr. S. Tagg.

Tully Gasification Plant with Waste-Heat Boiler and Automatic Operator

By Walter T. Dunn, M.I.Mech.E.

The writer recently took the opportunity of inspecting at the works of the South Oxfordshire Water and Gas Company, at Goring-on-Thames, the new Tully coal gasification plant which has been installed there. This installation is such a distinct improvement on the original Tully plant that, on being shown the differences, he felt that some description of the new plant would be of interest to readers of the "Journal." He is indebted to Mr. O. E. Yeo for the drawing and the photographs reproduced, and to Mr. Tully, Junr., who showed him over the works, and explained the operation of the plant, pointing out the various ingenious devices in connection with it.

At Goring, it may be mentioned, all Tully gas is sent out without enrichment or admixture of any kind. It was therefore of particular interest to notice from the recording instruments, &c., the behaviour of the gas when consumed in fires, illuminating burners, engines, and so on. The writer saw at work the gas engines actuating the high and low pressure pumps of the extensive water supply for which the South Oxfordshire Water and Gas Company is responsible. A large percentage of the gas produced at Goring is used for these engines, and has proved to be entirely satisfactory in that connection. Its performance in heating and cooking stoves, water heaters, &c., is equally satisfactory. In the incandescent mantle the gas gives a very bright light, the whiteness of which, compared with that from ordinary coal gas, is very noticeable, due evidently to the high flame temperature of the gas.



THE TULLY GASIFICATION PLANT AT GORING-ON-THAMES.

From the diagram it will be seen that the plant consists of a Tully generator, a waste-heat boiler, blowing machinery, patent mechanical operator, the customary seal-box, and auxiliary apparatus. The generator is of the usual Tully design, but the internal construction has been considerably improved through data collected during the experience of recent years. In addition to the standard fittings the generator at Goring has an automatic poker in the retort section, its function being to facilitate the downward movement of the fuel, and also to improve the carbonizing conditions within the retort, thereby ensuring that the coal shall be effectively coked before it reaches the lower or gasification section of the generator.

The grate of the generator is of the usual fixed type, but is provided with an ash rake, automatically operated, for the continuous removal of the ash, clinker, and refuse. This device results in considerably reducing the necessity for clinkering and cleaning the fire. The ash-pit is provided with water seal, and all ash, &c., removed from the grate is quenched in it.

On the waste gas outlet of the generator is a horizontal multitubular waste-heat boiler, the steaming capacity of which is sufficient to provide the whole of the steam required for driving the blower and operator engines, and also for gas making in the generator. Consequently, there is no independent boiler to stoke, and as the waste-heat boiler is provided with an automatic feed-water regulator, no labour whatever is needed for steam raising.

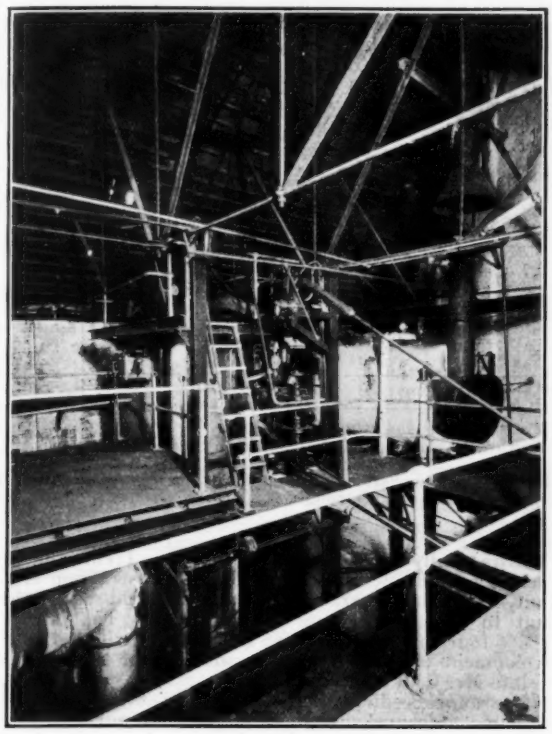
It may be remarked that, although the plant is worked for only one shift per day, no difficulty is experienced in starting up, the waste-heat boiler being designed to maintain an ample steam pressure over a long shut-down period.

The charging of the plant is done by means of a simple form of tip skip, the raising and lowering of which is effected by a water pressure cylinder and simple wire-rope gear. The water for working the hoist cylinder is obtained from the town supply main at a pressure of approximately 70 lbs. per sq. in. The discharge is conveyed to the supply tank of the boiler feed-water pump, thus a part of the boiler feed-water is first used to do all the elevating of the fuel. Only one skip of coal is required hourly, the filling and charging of which is practically all the manual labour involved in working the plant.

The patent mechanical operator specially interested the writer. Working with almost uncanny precision it opens and closes cycle after cycle all the operating valves of the plant, ensuring in each cycle the correct duration of both "blow" and "run." The operator is of simple construction, consisting of a single intermittently rotating cam-shaft to which all the operating valves of the plant are positively connected in such a way that they can only be opened and closed in the correct sequence. One complete revolution of the cam-shaft suffices for one cycle of opera-

tion, and is effected in six separate movements, the four major corresponding to (1) the "blow," (2) the "up-run," (3) the "down-run," and (4) the "purge."

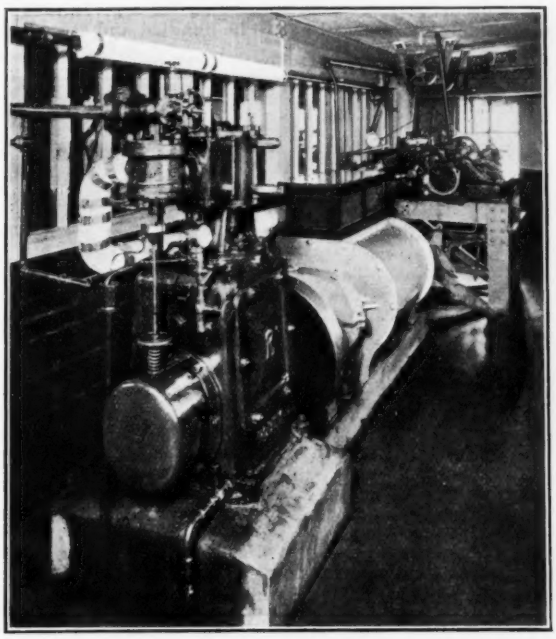
The duration of each period of the cycle is controlled by a positive-acting selector-gear which can be readily set to give the desired working cycle; and the operating machine



General View of Charging Platform.

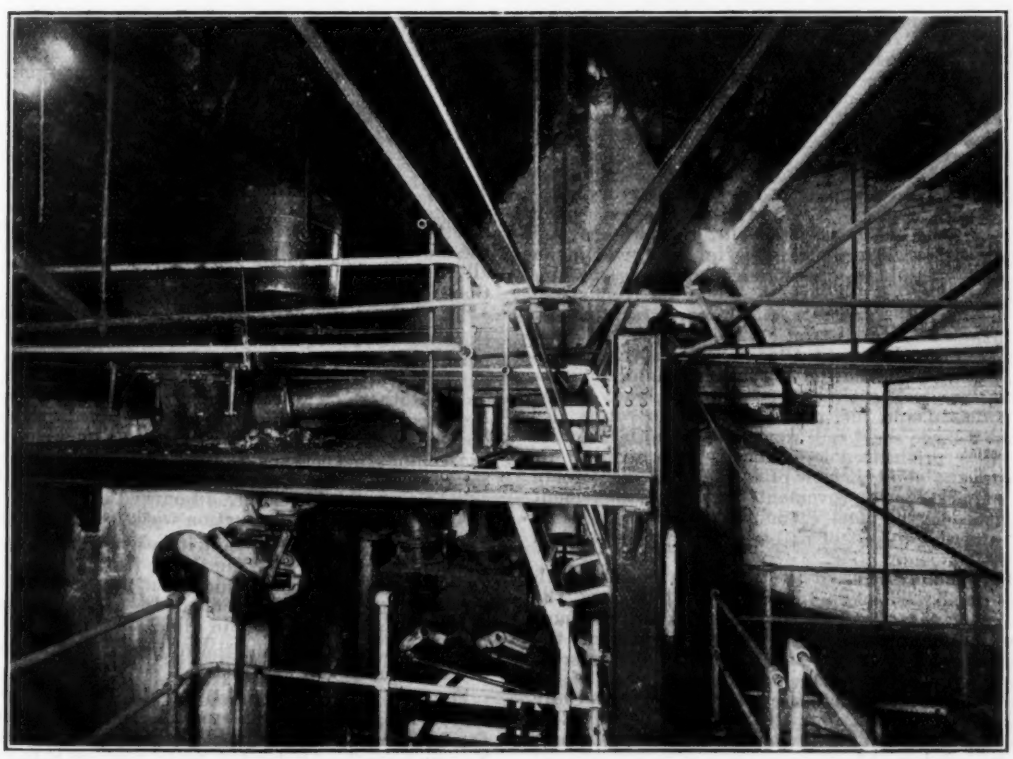
is driven through reduction gearing by a small steam engine, suitably governed.

The air-blast for the plant is obtained from a positive acting Roots blower which is direct-coupled to a high-grade enclosed vertical steam engine running at its full governed speed during the period of the "blow," and at an idling speed during the "run." The blower being of the positive type delivers a practically constant volume of air irrespective of the resistance of the plant. This circumstance, together with the accurate timing of the mechanical operator, enables the correct balance of air and steam to be at all times well maintained, a condition most essential, of course, to the efficient operation of any type of gasification or water gas plant.



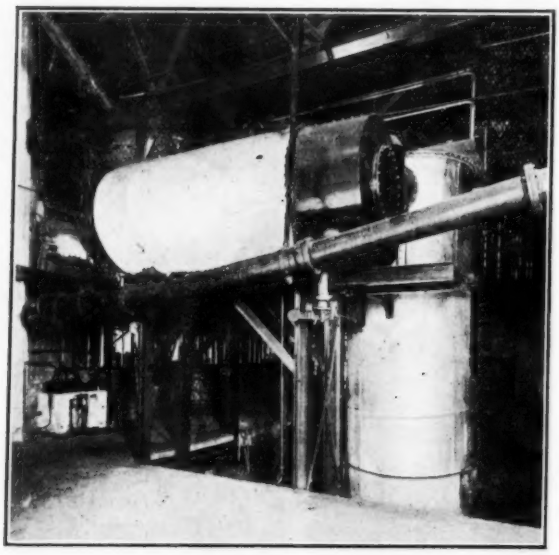
Engine House containing Roots Blower and Automatic Operator.

The new plant at Goring has a nominal capacity of 150,000 c.ft. of gas per day, but is capable of producing well in excess of that rating. Mr. Tully informed the writer that the size of this particular plant was chosen by the South Oxfordshire Water and Gas Company so that the whole of the gas required could be made in one shift per day. Although this provision somewhat increases the



CHARGING PLATFORM, COAL SKIP, &c.

stand-by losses it reduces the labour required to *one man for one shift daily*, and is therefore a decided economy. Moreover, the capacity of the plant enables a peak or abnormal load to be met by working the plant an hour or so longer. The plant being mechanically operated, and the whole of the steam-raising being automatic, the attendant has ample time at his disposal for all general duties about the works and yard. The coal being completely gasified in the plant no coke is produced, and, consequently, no yard labour in connection with that product is needed. It may be added that for a given make of gas considerably less coal has to be handled and stored.



Generator and Waste-Heat Boiler.

Naturally the writer was impressed by the absence of coke stock, storage, &c., and the fact of reduced coal requirements. Obviously such considerations materially reduce the capital necessary for providing coke screening plant, &c., and for the wages of supervision in connection therewith.

After leaving the seal-box of the plant the Tully gas passes through the usual scrubbing and cleaning apparatus to a relief holder. Thence it is passed through the purifiers to the town holder as required, the arrangement being automatic, so that no labour or attention is necessary after the gasification plant has been closed down.

Mr. L. J. C. Geer, the Engineer and Manager of the South Oxfordshire Water and Gas Company, has kindly furnished the following certified results of the behaviour of the plant at Goring-on-Thames, from which it will be seen that the average hourly make of gas is 8300 c.ft., the calorific value 364·9 B.Th.U., and the make of gas per ton of coal (Messrs. John Brown's gas coal) 45,528 c.ft. The C.V. tests were made with a Simmance water-flow calorimeter.

Hours Worked Daily.	Gas Made C.Ft.	Average Make per Hour. C.Ft.	Coal Used. Cwt.	Gas Made per Ton. C.Ft.	C.V. by Simmance Water Flow Calorimeter. B.Th.U.
8	47,800	6000	21	45,524	..
7	54,800	7800	24	45,666	..
7	62,100	8800	27	46,000	359·4
6	53,850	9000	24	44,875	363·4
5	45,900	9200	21	43,714	367·2
7½	61,100	8400	24	50,916	..
5¾	50,400	9100	24	42,000	369·7
45¾	375,950		165		
Average for week 6½		8300		45,528	364·9

NOTE.—The waste heat boiler provided all steam required for driving the blower and operator engine, pumps, &c.; and for gas-making in the generator.

Messrs. Tully & Sons, Ltd., Newark-on-Trent, the contractors responsible for the design and construction of the plant, are to be congratulated upon having brought their plant to its present state of perfection. The late Mr. Tully's four sons and Mr. Yeo have all contributed to the development of the work of the inventor of the system—the late Mr. C. B. Tully.

After an exceedingly enjoyable tour of the works the writer was informed that there are now a number of works sending out all Tully gas; among them being Horncastle (Lincs.), where the results over several years' working show an average make of 43,000 c.ft. per ton of coal carbonized, a figure which includes stand-by, boiler, and works fuel; that a Tully plant of 400,000 c.ft. capacity per day has just been completed at the Grantham Works; and that several other plants are in course of construction for works in Scotland and elsewhere.

Smoke Abatement in Sheffield

Slow progress, due in the main to the unsatisfactory state of trade, is recorded in the Third Annual Report by the Chief Smoke Inspector of the Sheffield, Rotherham, and District Smoke Abatement Committee for the year ended March 31. As a result of poor trade conditions, the inclination of manufacturers to spend money on reconstruction has been limited. However, the Report states that a number of furnaces in the district have been reconstructed, some of them with modern controlled methods and mechanical stokers, and some fitted for gas firing. Manufacturers all state they are well satisfied and that, in many cases, output is increased and fuel economy effected. It is also recorded that a large sheet mill works has fitted most of its furnaces with a pre-heated supplementary controlled air supply. From the point of view of smoke abatement there has been a remarkable improvement, and the management states that considerable fuel economy has resulted, while the quality and the output of material has not suffered in any way.

The Chief Inspector seems to be a little disappointed with the progress which gaseous fuel is making in the city. The present prices of gas afford the big manufacturers opportunity to get advantages, he says, but at the moment the small manufacturers cannot. An amendment of the scale of prices would give a tremendous impetus to the use of gas for process work and, at the same time, would materially assist the purposes of the Committee. When the Gas Grid scheme is completed, and trade conditions improve, much greater progress is hoped for.

It is stated that arrangements are in hand with the University for the institution of a course of training and instruction for firemen and furnacemen similar to that held in other industrial centres. The Report finally states that the old spirit of hostility against the Department is gradually disappearing, and a feeling of confidence and co-operation is taking its place.

The Committee in their own report state that observations were kept on 6144 chimneys during the year in various parts of the area, and that the average emission of smoke per hour varied from 2·7 minutes in Sheffield to 5·1 minutes in the Rotherham Rural District. During the year 26 cases were reported to the Committee for consideration; 17 cases were dealt with by sending warnings to the firms concerned, proceedings were taken against three steel works and one colliery, in which fines were imposed, and in two other cases the proceedings were adjourned and later withdrawn as the necessary reconstruction work had been carried out.

The Committee states that it has not taken any definite steps in connection with the smoke from domestic fireplaces as they are still of the opinion that the solution depends to a large extent on the extended use of gas and electricity, but they have the matter in mind.

The Report shows that the total cost of the Committee's work for the year was £1896.

Mr. R. Halkett (Sheffield), Mr. R. Watson (Doncaster), and Mr. H. Burton (Shipley) will be the representatives of the National Gas Council at the annual conference of the National Smoke Abatement Society which is to be at Sheffield from Sept. 22 to 24.

Trade Wastes from Gas-Works*

By Alexander McDonald, B.Sc, Assoc.M.Inst.Gas E., Engineer and Manager, Motherwell and Wishaw Corporation Gas Department.

One cannot contemplate lightly the presentation of a technical paper to our Association. For that reason, I have hesitated in putting before you a few thoughts on one aspect of our profession which has seriously exercised many of our minds for some considerable time.

I have used the word "thoughts" advisedly, since thoughts ultimately lead to beliefs, and on our beliefs our actions are based.

If we realize that our thoughts do commit us to certain lines of action, then it will be evident that we must cultivate a certain elasticity of thought which will allow us to doubt, test, and, if necessary, revise our ideas. Circumstances forced this attitude upon me, so that I was ultimately brought to consider the advisability of discarding sulphate of ammonia manufacture for other methods of liquor disposal.

I have therefore chosen the title "Trade Wastes from Gas-Works," since at the present time the wastes may take one of several forms. Our experience of the waste from a sulphate plant, by diluting the raw ammoniacal liquor, and from a concentrated liquor plant may be of interest to some.

I propose to go fairly thoroughly into several of the methods which may be adopted and to show that in our case a concentrated gas liquor plant has made a direct contribution to two outstanding problems:

(*a*) Reducing the toxicity of our "trade waste."

(*b*) Alleviating the loss on treatment of our liquor.

The Effluent Problem.

The "trade waste" from any gas-works arises primarily by collecting the liquor condensed from the gas stream and the water used during the processes of washing and scrubbing the gas. The liquor thus formed may be considered as "trade waste," or it may be treated for the recovery of ammonia by one of several processes, when the effluent from the plant adopted becomes the trade waste.

Any of these effluents requires treatment before it is suitable for discharge to the waterways owing to the fact that it contains bodies capable of absorbing oxygen. This is expressed as the "oxygen absorption" (O/A) figure, and is used as a rough measure of the toxicity or pollution of the liquor.

The O/A figure is based on the amount of oxygen by weight which 100,000 parts of the liquor will absorb from a standard solution of potassium permanganate.

The absorption of oxygen by the liquor is due largely, but not entirely, to the presence of—

(*a*) Phenols and higher tar acids.

(*b*) Thiosulphate.

(*c*) Thiocyanate.

The higher tar acids also give further trouble due to the fact that on oxidation they are capable of yielding colour-producing bodies which cause visual pollution on discharge to streams, &c.

It is an unfortunate fact that ammoniacal liquor is capable of dissolving-out phenolic bodies when in contact with tar. This is readily demonstrated by shaking up some ammonium hydrate with a little tar, when the resulting solution will have an O/A figure as high as 350 to 400. From this, one realizes that the tar and liquor should be separated as soon as possible before going to the well.

It has been shown elsewhere that the O/A figure of an average effluent from a works with horizontal retorts is approximately 600. The introduction of vertical retorts has increased the difficulties, since the O/A figure may be as high as 1100 or 1200, and in some cases even in excess of this. The position therefore is not encouraging, and it has been thought advisable to take steps to improve the effluent.

As already indicated, the separation of the tar and liquor at an early stage is one step in the right direction. Another suggestion which has been made in order to reduce contamination is to remove the tar above the dew-point of the gas—that is, before the liquor has had time to condense. For this purpose a fixed ammonia spray has been utilized with some measure of success.

Further, the plant having the shortest time contact has given an improvement. Thus, water condensers and rotary scrubbers have been used in place of atmospheric condensers and tower scrubbers.

Thiocyanate and thiosulphate, which are the cause of increased toxicity, are to some extent formed by oxidation, so that they can be minimized and the toxicity largely reduced by cutting down all air infiltration to the gas stream.

I do not propose at the moment to discuss the *pros* and *cons* of these methods, but rather to deal with the effluent as most of us find it. The possibilities in these suggestions are worthy of a paper to themselves.

At this point I might refer to one or two of the recommendations which have been made. Some years ago, a Royal Commission was set up to deal with this subject, and they stated that in their opinion gas liquor effluents were innocuous to sewage and sewers, provided that the effluent was discharged regularly and not in flushes; also that all solid matters were carefully eliminated before such discharge.

From our experience at Motherwell this point of a carefully regulated flow can be emphasized. By regulating the flow of effluent to suit the flow of sewage, a constant O/A figure can, as far as possible, be maintained at the sewage works inlet.

The Commission also stipulated that the amount of effluent discharged should not exceed 2% of the total flow of sewage, and that the temperature should be even. Normally the quantity of effluent seldom exceeds ½%, so that considerable dilution by all waste water should be of assistance. This, together with a regulated flow, should not affect appreciably the operation of the bacteriological beds.

It does not follow, however, that the relative difficulties of purification are proportional to the O/A figure. This figure is only a rough measure of the amount of oxidation required. It gives no indication of the ease with which oxidation occurs, and it has been shown at Cheltenham that sewage, even with its low O/A figure, is not so easily oxidized as spent liquor.

An analysis of the position as it affected Motherwell will illustrate the difficulties. For some considerable time we had been manufacturing ordinary quality sulphate of ammonia, using a Gillespie type still and open hand-fished saturator. Within recent years, however, market conditions had thrown a burden on the Department, so much so that the losses incurred varied from £400 to £600 per annum. We were not in the fortunate position of being able to discard manufacture, as we had no alternative means of disposing of our liquor. Even at this time the Sanitary Inspector was taking up an unfortunate attitude with regard to the effluent from our sulphate plant, as he was suggesting that we would require to install a plant to deal with it.

A careful survey of the effluent was carried out which showed it to be slightly alkaline in nature, while it turned a deep reddish cloudy brown on exposure to air. The addition of acid to the effluent prevented the formation of this coloration, but on mixing with the sewage the acid was neutralized and the brown colour immediately reappeared. It was useless, therefore, to acidify the effluent and obtain a temporary improvement in colour. The cost was also a deciding factor. An analysis gave the following results:

Table I.

	%
Total ammonia	0·084
Suspended matter	0·017
Residue on evaporation	0·72 (tarry)
Oxygen absorption	950 to 1050 parts per 100,000

In order to show that these figures are, in the main, normal, I append similar analyses from two works, neither of which was experiencing any difficulty in the disposal of its effluent via the sewers:

Table II.

Nature	Neutral	..	Neutral
Colour	Brown	..	Brown
Suspended matter	0·044%	..	0·035%
Residue on evaporation	0·756%	..	0·783%
Oxygen absorption	964	..	945

An analysis of the liquor as formed during the different operations of purification was also carried out. The

* Paper read before the North British Association of Gas Managers, Sept. 7, 1933.

results are given in Table III., and disclose the fact that, while the liquor from the hydraulic main is the least valuable as a source of ammonia, it is the most harmful when its toxicity is judged by the O/A standard.

TABLE III.

—	Hydraulic Main.	Water-Tube Condensers.	Atmospheric Condensers.	Livesey Tar Extractor.	Scrubber (Rotary).	Liquor Well.
Free ammonia, %	0·14	0·98	2·29	2·37	1·51	1·19
Fixed ammonia, %	0·12	0·04	0·07	0·07	0·12	0·07
Total ammonia, %	0·26	1·02	2·36	2·44	1·63	1·26
Specific gravity	1·005	1·01	1·03	1·04	1·03	1·02
° Tw.	1·5	3	6·5	8	6	4
O/A figure.	1298	1140	1134	947	702	1047

It is evident therefore that disposal of the least valuable portion of the liquor occasions the greatest difficulty. In order to reduce our sulphate costs we might have been disposed to run this liquor to waste, but the difficulty of the sewage works always faced us.

Samples of the ordinary sewage inflow which did not contain our effluent were next obtained. These proved to be a normal domestic sewage with an O/A figure of 8-10 parts per 100,000. Regular tests of the mixed effluent and sewage over a period of one month showed some variation. The maximum figure was 25 and the minimum 12 parts per 100,000.

Table IV. gives the purification obtained at the sewage works over regular daily tests. Information regarding the rate of treatment or quantities treated was not at our disposal, but the figures indicate that an average purification of approximately 90% was obtained.

TABLE IV.

—	Sewage Inflow.	Dozing Chamber.	No. 3 Filter.	No. 4 Filter.
Maximum	25·56	9·50	6·14	5·35
Medium	17·68	10·21	3·74	3·34
Minimum	12·18	4·97	1·57	1·23
Average (24 tests).	17·0	8·4	2·6	2·0

The Sanitary Authority had, however, raised the matter with the Town Council, and we had perforce to consider the different methods of dealing with the problem.

As we saw it, the various alternatives may be summarized thus:

(1) Adopt destructive methods for the raw liquor.
(2) Discharge the raw liquor to drain as a trade waste.
(3) Continue sulphate manufacture with effluent treatment.
(4) Install concentrated gas liquor or other plant and consider if effluent treatment is necessary.

With your permission, I now propose to deal with each of these in turn and to show why I discarded each in favour of the last alternative.

DESTRUCTIVE METHODS.

Several methods of destroying the ammoniacal liquor have been proposed and examined. Briefly, these are:

(*a*) *Coke Quenching.*

The ammoniacal liquor is first diluted with about five times its own bulk of water and the dilute liquor used to quench the red hot coke. The drainings are returned to storage and re-used to dilute the incoming raw liquor. The aim here is to utilize the heat of the coke to destroy the ammonia and other objectionable bodies.

Some experimenters found that ammonia fumes were given off and this caused sickness of the workmen. Others reported satisfactory working if sufficient dilution was adopted.

This method, while it might conceivably be applicable in the case of horizontal retorts or coke ovens, is useless for vertical retorts where the coke is already "hand-cold" when discharged.

(*b*) *Destruction in Producers.*

The principle adopted in this case is to use the liquor on the furnace bars in place of water, by which means it is evaporated and the ammonia is destroyed on passing through the furnace. On paper this method has attractions, but tests have shown it open to several difficulties. In the first place, experiments proved that without increasing the fuel consumption in the furnace only a proportion of the liquor could be so treated. Any benefit obtained was counterbalanced by excessive costs, and the problem still remained.

Secondly, it was found that ammonium salts were deposited in the flues, proving that destruction was incomplete, while, if the furnaces were situated in enclosed spaces, it became necessary to install fans to remove the ammonia fumes.

Further, we cannot neglect the cost of pumping, which would generally be necessary to take the liquor to the furnaces.

(*c*) *Spraying the Liquor into Hot Waste Gas Flues.*

In some works, the so-called "devil liquor" from the sulphate plant has been disposed of by spraying it into the base of the chimney. Like the previous method, there is a limit to such a system, so that the whole of the liquor could not be treated thus. Other methods would require to be combined with it.

It is estimated that the removal of the "devil liquor" reduces the toxicity of the effluent by 20%. While this represents a considerable benefit, I should imagine that it would be the cause of atmospheric pollution. There would still be a burden on the Department.

(*d*) *Total Evaporation.*

The suggestion of total evaporation fails on account of the prohibitive cost, since it is seldom that there could be sufficient waste heat available. A simple calculation emphasizes this very pointedly. Assume that there are 30,000 gallons of liquor to be evaporated per day, and that 1 lb. of coke has an evaporative power of 5000 B.Th.U. This figure, of course, is allowing for efficiency. The amount of coke required would be approximately 28 tons, and allowing 5s. per ton, the cost would be about £7 per day. Rather a staggering figure!

All of these methods are wasteful, lead to atmospheric pollution, and are costly. If it is possible to find a more suitable process, then it has a prior claim on our consideration.

RAW LIQUOR AS EFFLUENT.

In view of the fact that the Sanitary Authority was raising objections to the effluent from our sulphate plant being discharged into the sewers, we were fortunate in being allowed, during a transition period, to run our liquor to the drain. Permission was even then only granted as a temporary expedient while we were installing a concentrated liquor plant, because no other outlet was available.

The results obtained make it necessary for me, at this point, to give a word of explanation. It will be remembered that we supply gas to a united Burgh from a centralized manufacturing station at Motherwell. Consequently, the total effluent leaves this works. On the other hand, the Sewage Works which deals with our effluent only serves a portion of the Motherwell area. It will be seen, therefore, that the trade waste leaving our works is somewhat in excess of the normal ½%, though I cannot find that it is in excess of the prescribed 2% already mentioned. Further, the gas-works are in close proximity to the sewage works, so that there is neither adequate mixing nor the normal dilution. These remarks must be carefully borne in mind before comparisons are made.

Because of the objections to our effluent, we took special precautions to deal with the raw liquor before consigning it to the sewers. The liquor was first pumped from the underground liquor well to an overhead storage tank, where it was allowed to settle, and any tar separating was run off. The liquor was then run by gravity to a carefully prepared and graded coke filter—the liquor being delivered in the form of a spray. As the liquor passed to the spray it was considerably diluted, and as it left the filter it had to pass under a shield which retained any floating light oil or scum passing the filter. The resulting liquor was then collected in a storage tank and run in a regular flow to the sewers.

The liquor was diluted from the normal 4° to 5° Tw. to a maximum of 1° Tw., which figure it was never allowed to exceed. It was a light straw colour when diluted, but darkened somewhat on exposure to the air; had an O/A figure of approximately 350 parts per 100,000 and an ammonia content of only 0·3%.

In spite of our precautions, complaints were made from the sewage works of serious frothing, and this difficulty we were never able to overcome. At the same time, we were informed that considerable difficulty was being experienced in working the bacterial filters satisfactorily.

During the period we were privileged to dispose of our liquor in this way the weather was fairly dry, so that we did not obtain the benefit of the natural drainage. Consequently, the O/A figure at the sewage works inlet periodically rose as high as 28 parts per 100,000 in spite of the fact that our waste was diluted to 350. We were unable to obtain regular tests of the sewage works outlet, but the figures we did obtain indicated a purification of only 70%, with a final O/A figure averaging 9-10 parts per 100,000.

From this, it is apparent that it was more difficult for the sewage works to deal with raw liquor which had an

O/A figure of 350 than with sulphate plant effluent with an O/A figure of 1000. This further proves that the O/A figure is only a very rough measure of toxicity, and it is far from correct to judge a trade waste by this standard. It seems reasonable to suppose that in our peculiar circumstances there was insufficient dilution by the sewage and that the higher ammonia content acted as an antiseptic on the filter beds. This would appear to be confirmed by the general complaint of the Sewage Authority regarding the functioning of their plant.

In such a case, everyone will agree that close collaboration with the Sewage Authority is essential in order that their difficulties are not unnecessarily increased. Regulation of the flow, after settling and filtering, to suit the amount of sewage, is certainly desirable.

While the above gives an outline of our experience, I want it to be clearly understood that there were peculiarities in our case, so that these results cannot be accepted as universal.

Sulphate Plant Effluent.

I have already given you some idea of the nature of the effluent which had been leaving our sulphate plant and to which the Sewage Authority had been taking exception. I should probably add here that this effluent was not only carefully filtered but passed to a cooling tank before discharge to the sewers.

It was quite evident that if sulphate manufacture were continued the Sanitary Inspector intended to press for some form of purification plant before he would accept the effluent. I had several consultations with him, when the possible methods, the effect on the effluent, and the cost to our Department were all discussed. These are now summarized:

(a) Bacterial Treatment.

The plant used in bacterial treatment consists essentially of a tower packed with graded clinker which has been innoculated with suitable organisms and carefully matured in order to multiply and spread them. The method consists first of all in diluting the effluent with the requisite amount of water to give a suitable O/A figure. Subsequently, previously treated liquor is used for this dilution by collecting it in a convenient mixing tank. The diluted liquor is passed through the bacterial filter at such a rate as will allow the organisms to purify it as much as possible. It is claimed for this method that a 95% improvement can be obtained, and a final waste suitable for discharge. A horizontal retort effluent of approximately 600 would therefore have a final O/A figure of about 25 parts per 100,000, and a vertical retort effluent of 1100 would be reduced to 40 parts after treatment.

The purification of this method appears to be satisfactory, but the plant takes up a good deal of ground space, capital charges are heavy, and pumping, &c., charges must be added to the losses already incurred on sulphate manufacture.

(b) Dephenolation.

The waste liquor has been dephenolized by passing the effluent down a packed tower, up which flue gas and steam are made to pass. The carbon dioxide in the flue gas renders the effluent acidic, and the steam causes distillation of the phenols.

A possible recovery of 90% of the phenols is said to be possible by this method, but be it noted that it is only the phenols which are removed. This means that, depending on the amount of phenol present, an effluent with an O/A figure of 1100 would be reduced to 700 or 800.

Here again there are capital charges, steam and pumping, &c., costs, and only partial purification is obtained. It is doubtful if there can be any material return on the phenol.

Several processes for the removal of phenols by the use of solvents have been adopted, and one, using benzole, is typical. In this case the liquor flows through the extractors with benzole flowing in the opposite direction. In order to liberate the benzole for re-use, the solvent charged with phenol is sprayed through towers containing caustic. The phenolic solution is then purified by distillation, and the phenols are finally liberated with sulphuric acid or carbon dioxide.

On the other hand, the benzole may be recovered by distilling the benzole-phenol solution at 80° C.

These processes are claimed to be profitable, but I cannot ascertain if any allowance was made for loss of solvent, and it may be observed that the large volume of effluent, the small concentration of the phenol, and the impure product obtained are decidedly disadvantageous.

(c) Preparation of the Effluent.

The question of preparing the effluent for treatment at the sewage works appears to me to be the only reasonable proposition. In this connection, close co-operation with the Sewage Authority is essential, since it is desirable to maintain as constant an O/A figure at the sewage works inlet as is possible. It must be realized that the volume of sewage is as variable from day to night and from month to month as is the demand for gas. It is further seriously affected by the weather, such as a prolonged dry or rainy period.

In order to attain this end, the effluent must be suitably filtered and cooled; it is then run to balancing tanks so that the flow to the sewers can be regulated as required. If this is carefully carried out, there seems no reason why satisfactory results cannot be obtained. After all, we exist to supply gas to the community and not as a purification works, which is the function of the sewage works. It will become a very serious matter for small and medium-sized works if they have to add the cost of purifying their effluent to any loss following on sulphate manufacture.

From our point of view any of the methods sketched are not a success if they constitute a burden on the Department without an improvement which can be otherwise obtained. This, combined with reasons which will be apparent later, decided me in investigating the claims of concentrated gas liquor.

Concentrated Gas Liquor Plant.

The difficulty of effluent disposal was complicated by the fact that extensive repairs to the sulphate plant became necessary. The saturator itself required complete renewal. The plant generally required overhaul, and the building extensive repairs. Altogether, we estimated that the necessary repairs could not be carried out under £800, and in view of what I have already recounted I was constrained to find out if this money could not be more usefully employed.

We could not forget the existing loss on sulphate manufacture, and the fact that the effluent question might possibly involve not only capital costs but working costs. Even if these costs were not prohibitive, a partial improvement only could be guaranteed.

After full consideration, I felt justified in recommending my Committee to adopt a concentrated gas liquor plant. I hoped that this plant would serve a double purpose. First, from the quantity of liquor which we had to treat and the prices obtainable I estimated that, even if we did not make a profit, our former loss on sulphate manufacture could be eliminated.

Secondly, it had been shown definitely that a certain amount of oily matter and crude phenol condensed along with the liquor. This accumulated on the top of the storage tank. An analysis of this deposit indicated that it contained as much as 40% of phenol. Consequently, the effluent from this plant would be considerably less toxic than that from the sulphate plant. Further, there was no "devil liquor" to dispose of. It was estimated that the improvement would be as much as 20%. This figure being almost as good as can be guaranteed by some methods of effluent treatment, it carried a considerable amount of weight.

I propose now to show that, even without a full year's working, it is evident that both of these ends will be attained.

It is not my purpose to deal here with the actual manufacture of concentrated gas liquor. That would really mean repeating a paper so admirably presented last year. Suffice it to refresh your memory. The plant consists essentially of a filter which leads to a liquor storage tank. From here the liquor is pumped to the preheater—heated by the outgoing ammonia stream—and passes to the still. Here it meets a supply of steam which drives off the free ammonia and is ultimately condensed in the preheater condenser, collecting in an overhead storage tank. The whole plant is under automatic control, the still head temperature being maintained by regulating the supply of liquor which is interconnected with the steam supply. Back pressure cuts off the supply of liquor and allows the steam to pass forward, thus clearing any choke. If the chokage persists, the steam is cut off and the plant automatically shut down. Labour charges are therefore minimized.

Turning to the results obtained, the plant was designed for a nominal throughput of 10 tons per day, and a special coil was placed in the concentrated liquor tank so that the liquor could be kept slightly warm and thus avoid the deposition of ammonium bicarbonate. It was hoped that by this means a concentration of over 20% would be maintained. Up to the present time, this concentration has not been required, and we have worked to produce a liquor of 16% ammonia, which has been easily obtained.

The Alkali Inspector was not satisfied that the arrangements for treating the waste gases were ideal, and it was ultimately agreed to put in a small purifier with connections to both the concentrated and raw liquor tanks. This purifier, as in sulphate manufacture, ensures that no sul-

phuretted hydrogen goes forward to the atmosphere, and has now been adopted as standard.

We were determined to take every reasonable step to make the effluent from this plant satisfactory to the Sanitary Inspector. With this end in view, we installed a filter similar to that already described, and arranged to pass the waste liquor to a cooling tank before discharge to the sewers. We regulate the plant to work 24 hours per day, so that by this means we are able to give a regular flow—though not meantime a regulated flow—to the sewage works.

An analysis of the effluent with the plant working on its nominal capacity is given in Table V.

TABLE V.

Total ammonia	0·070%
Suspended matter	0·018%
Residue on evaporation	0·304%
Oxygen absorption	500-600

From these figures we can appreciate the fact that, if the degree of pollution is judged by the O/A figure, the effluent from this plant is between 40 and 45% better than that from our old sulphate plant. This improvement is even better than we could have expected from some methods designed entirely to improve the effluent.

As indicated under the heading of raw liquor, however, the O/A figure of our outflow is not the ultimate criterion, but rather the result obtained at the sewage works. Consequently, after a period to allow the bacterial filters to come back to normal working, I inquired into this question, and was assured by the Sewage Authority that they were certainly experiencing considerably less trouble and the purification was again more normal. I consider that this is certainly satisfactory, but whether it will be possible to satisfy them or not is another matter.

While dealing with the effluent improvement, the results obtained by working the plant on varying throughputs might be of interest. We found that by working the plant at approximately 75% in excess of its nominal capacity the improvement on the old sulphate plant was in the region of 20%. This is illustrated in Table VI.

TABLE VI.

—	75% Capacity.	Nominal Capacity.	50% Excess.	75% Excess.
Total ammonia, %	0·068	0·070	0·095	0·12
Oxygen absorption	444	636	718	784

TABLE VII.

Income—		
500 tons concentrated liquor 15-16% ammonia		£494
Expenditure—		
Labour	£50	
Steam and working costs	183	
Carriage at 3s. 11d.	98	
		331
Gross profit		163
Deduct interest and sinking fund charges		85
Net profit		78
Add former loss		500
Total gain to the Department.		£578

Turning very briefly to the financial results, we find that, in addition to saving the former loss on sulphate, we shall be able to make a small profit. It is, of course, impossible to put an exact figure on maintenance, as this is a new plant. I see no reason, however, to assume that this will be in any way excessive. The estimated results for a year's working are tabulated in Table VII. These are based on the results obtained during the last four months.

If this is the position with poor ammonia markets, we can hope for even better results should these markets improve. I do not propose to say any more on the financial side, as this paper deals more particularly with the effluent side.

SUMMARY.

Permit me now to summarize briefly the different points as I see them.

(1) The trade waste from a gas-works may take one of several forms, but all of them bring their own disposal problems.

(2) The cost of liquor destruction may be excessive for no return; it causes atmospheric pollution and is frequently only palliative.

(3) Dilution of the raw liquor in our case caused somewhat serious trouble at the sewage works, due largely to our peculiar circumstances.

(4) Treatment of the effluent from a sulphate plant is frequently only partly successful; the cost must be added to the loss on sulphate, and it takes up valuable space. In any case, this is not the function of a gas-works.

(5) A concentrated gas liquor plant has reduced the toxicity of our effluent by a considerable amount and has, incidentally, improved our financial position.

CONCLUSION.

A full survey of the problem as it affected our Department did not in my opinion justify us in continuing sulphate manufacture or in adopting effluent treatment plant. The method adopted, while it may not be universally applicable for a variety of reasons, has made a direct contribution to two serious problems.

Routine work presses on us with all its manifold cares and worries, and in the task of getting through this to the best of our ability we have little time or opportunity of sitting down to think. If we did, we might lay ourselves open to a charge of idleness.

If there is one thing to which good men all too readily become enslaved, it is routine and habit. It is not through laziness or lack of energy, but through lack of perspective. The immediate tasks of the day loom large, obscuring the needs of to-morrow; and on these immediate tasks we use up our daily strength.

If the notes I have put before you have enabled even a few to spend some moments on a new line of thought, so that they can go ahead with a clearer view of their objective, then I am amply justified.

Discussion.

The PRESIDENT complimented Mr. McDonald on a very painstaking effort on a subject of which, he said, very few of them had had any experience. Twenty-five years ago he had attempted to clarify effluent, not because of any difficulty with the sewage authorities, but because he wanted to use it to keep up the water level in the gasholder. He had used sulphur dioxide for this purpose, but the acidity produced from the thus-formed sulphurous acid reached such a degree that the metal work was attacked. Paisley had, at the moment, no sewage purification works, but the Council were considering this matter, and a move would probably be made very soon. He considered it a peculiar thing that industrialists should have trouble with the sewage authorities, as he thought it was the prime object of any sewage works to purify effluent.

Mr. R. J. PHILP (North Berwick) said he himself had been the first to install a concentrated ammonia plant in this country, and he had been aware of the difficulties which Mr. McDonald had been experiencing at Motherwell. He had pointed out that the effluent from a concentrated ammonia plant was less harmful than that from a sulphate plant, and he was glad to hear that this had proved to be the case. The oxygen absorption figure at North Berwick was 1025, though it should be about 500; the high figure being due to the fact that the tar and liquor were stored in the same tank. He also explained that, after negotiations with the railway company, he had secured special rates for concentrated ammonia liquor. During the nineteen months his plant had been working he had spent nothing on repairs.

Mr. J. W. NAPIER (Alloa) said that the subject was one of increasing interest to gas undertakings. Local authorities were now inclined to insist on some system of purification which would prevent river pollution. The case of Motherwell seemed to him to be exceptional, as it had been admitted that there was not sufficient mixing or dilution, and, in addition, the effluent contained free ammonia. In Alloa the effluent was run into a tidal river, where the dilution was great, and no difficulty had been experienced. In other cases trouble had been caused by the phenols present in the effluent. This was due to the contact of the ammonia and the tar, and in future the rapid separation of tar and ammonia should form a distinct step in the process. He disagreed with claimed advantages of the concentrated ammonia plant, and said it was evident that, in the disposal of the ammonium sulphate, Mr. McDonald was not a free trader. This disability was not present in his case, and he managed to make ammonia sulphate pay. The effluent from the concentrated ammonia plant was, however, 50% less toxic than that from the sulphate plant, and it was therefore to be recommended to gas undertakings where the effluent was discharged to sewage purifier beds. Local authorities were taking a strong view on this matter of effluent discharge and, in some cases, were creating difficulties for industrialists. Nothing should be done to incur too great an expense on industry, though undertakings should not discharge an unnecessarily toxic effluent. The Scottish Advisory Committee on River Pollution lacked evidence on gas-works effluents, and this paper should be very useful to them. He considered it the duty of the local authorities to supply sewers suitable for local conditions and thus avoid any special charge on undertakings which complied with the necessary preliminary purification.

EXCESSIVE FROTHING.

Mr. D. VASS (Perth) remarked that there was only one point on which he wished to comment. That was in connection with the excessive frothing which had been caused at the sewage works by the discharge of the gas-works effluent. He had had a similar experience. His ammonia liquor, before being discharged into the river, was filtered and passed into a small pool. Frothing took place, and this was entirely due to the inrush of the liquor. The outlet from this pool was under the level of

the liquor so that any residual tar in the liquor collected on the surface as a scum and could thus be removed.

Mr. J. WILSON (Dundee) said that Mr. McDonald had got rid of his trade waste by tackling it at its source, but he (Mr. Wilson) thought it would have been interesting to have heard how terms could have been arranged with the Sanitary Inspector with regard to the original effluent. The frothing at Motherwell he considered to be entirely due to the physical nature of the flow into the tanks; if it were allowed to percolate quietly there would be no frothing.

THE AUTHOR'S REPLY.

Mr. MCDONALD, in reply to the discussion, said that he was glad to have Mr. Philp's corroboration on the advantages of the concentrated ammonia plant, but he was surprised to hear that the oxygen absorption figure was so high at North Berwick. If, however, there was only one storage tank this was easily explained. In his early experiments at Motherwell he had shaken up tar and pure ammonia and was surprised to find that he could produce almost any oxygen absorption figure. He had hoped that, in his paper, he had made it quite clear that the conditions at Motherwell were exceptional, so that the experience he had had could not be held up against any other undertaking. In the effluent from the sulphate plant the ammonia was not free but fixed and present in such small amount as to make its removal unprofitable. He agreed that the presence of the phenols constituted the real trouble, and, in spite of the improvement in his effluent, he was considering installing a different system for the separation of the tar and ammonia. The loss on the manufacture of ammonium sulphate was due to a certain extent to the fact that the sulphuric acid came in drums as they had not the facilities for tanks. The frothing difficulty was not his trouble, but was undoubtedly due to the meeting of different streams at the sewage works inlet.

Development of Public Lighting in the City of Bombay*

By J. P. BLACKMORE, Public Lighting Superintendent, Bombay Gas Company.

Bombay is a densely populated City, 11½ miles long and from 3 to 4 miles wide at its widest point. In this small area of 22 sq. miles live, and, I am sorry to say, not always amicably, 1,161,383 souls, of which there are 789,861 Hindoos, 209,246 Moslems, 80,728 Christians, 57,765 Parsees, and 23,783 others; these speak no fewer than 62 different languages or dialects.

There are 216 miles of street lighting in Bombay, of which 140 miles are illuminated by gas, 65 by electricity, and 11 by incandescent oil lamps, the total number of lamps used is: Gas 7329, electricity 1315, incandescent oil 230, and ordinary kerosene burners 20. All lamps, lanterns, columns, and brackets are the property of the Municipality, although in the first instance these are supplied and erected by the contractors. The Municipality maintains a Supervising Lighting Department, consisting of a Sub-Engineer and Inspectors, whose duty it is to see that the various contractors maintain the lamps according to the terms of the contracts, to investigate complaints, and to check the contractors' bills, which are forwarded monthly. The Municipality pays the contractors a flat rate per lamp according to size and type, which rate includes gas or electricity consumed, lighting and extinguishing to Municipal schedule times, maintenance of glass, mantles, &c., and the annual painting of columns or lamps. The repairs to lanterns and columns, and replacements which are other than fair wear and tear, are carried out by the contractors on orders received from the Municipal Inspectors, and are charged for in a separate monthly bill.

A portion of the Town was first illuminated by gas with flat flame burners in 1866; "C" burners were introduced in 1900, inverted burners in 1908, and high-pressure gas in 1911. No progress was made during the war and up to September, 1923. At this date the town was principally illuminated with "C" burners, with a few hundred inverted lamps and about 200 high-pressure lamps.

In this sketch I will endeavour to show how Bombay was able to introduce modern efficient and economical illuminants without any material additional burden upon the taxpayer. I realize, however, that climatic conditions and cost of labour are responsible for many differences in general practice, and some of our methods which are considered as economical and efficient here may not be so in England.

The "C" burners were fixed in hexagonal shaped strong copper lanterns, mounted on 9 ft. cast-iron columns. This shape of lantern was used, despite the disadvantage of six ribs, as large glass was then costly to import. The inverted universal size mantle lamps, both 1 and 2-light, were mounted on swan necks, from 12 to 15 ft. to the reflector, and these were considered to be the last word in low-pressure lighting.

In October, 1923, after prolonged tests with various types, the first 2-light No. 2 size mantle superheated burners were fitted to replace the "C" burners. Each conversion set consisted of an enamelled steel reflector with an aluminium uptake, a brass trap with glass ball, a burner of the "T" head type with circular superheater, and the nozzles placed on either side of the bunsen tube, which was provided with gas and air regulators, and, last, but by no means least, a 3 ft. cast iron extension piece to extend the 9 ft. columns to 12 ft. and the height to the mantles 13 ft. 6 in. The unsightly appearance of the "T" head type of superheater burner was a disadvantage, but, as 80% of our labour is unskilled, we required simplicity. Each conversion represented a considerable saving in maintenance costs and an increase in candle-power.

THE LESS IMPORTANT ROADS WERE IMPROVED FIRST.

I wish to emphasize this point, for it is contrary to the usual ideas. The saving made on the smaller roads, which amounted to 18s. per lamp per annum, provided funds for further conversions and ultimately enabled the Municipality to erect really modern illuminants on the wide thoroughfares. In the meantime we were in the peculiar position of having the side roads better illuminated than many of the important streets. This, however, did not last more than a year or so. Most of the tram routes were provided with 200 and 300 watt electric lamps with prismatic glass equipment, mounted on alternate tram poles, while on other roads gas lamps of various sizes were erected on 30 ft. steel poles with 7 ft. brackets, and some were centrally suspended. These installations released a large number of lanterns and cast-iron columns which have been used, partly on new minor roads and principally in the re-arrangement of the previously converted lamps which were 120 to 200 ft. apart. These were moved, and the released lamps inserted to even up the spacing to 120 ft. diagonal. Each road was treated on its merits, but, as a rough standard, those up to 40 ft. in width retained the hexagonal lantern with 2-light conversion set, but some of the more important of these roads were provided with 3 or 4 light conversion sets.

After the "C" burners were all converted, the old universal mantle lamps received attention and were provided with 2-light No. 2 size mantle superheater burners in place of each universal mantle. These conversion superheaters were cheap and very efficient and all went well until the first rainy season, when it was found that the globes, which up to that time had been quite satisfactory, were not sufficiently heat-resisting to withstand the additional heat during horizontal rain. This difficulty has to a large extent been overcome by the use of superior heat-resisting glass, but the breakages are high compared with lamps originally designed for cluster burners. The improvements on the main road are still being carried out, and we have reached a stage where roads previously improved with conversion sets are now being provided with steel column and suspension lamps.

Having traced the general trend of the improvements and shown that most of them were consequent on the earlier conversions and the resultant reducing in maintenance costs, I will now endeavour to describe typical installations of the various types in use. The 2, 3, and 4 light conversion burners in hexagonal lanterns, of which there are 4156, are in general use in the bazaar roads and residential areas, the height to the mantles being 13 ft. 6 in. and the spacing 120 ft. diagonal. In many of the bazaar roads, footpaths are not provided, and in such places the lanterns are erected on brackets attached to the buildings or on columns close to them. Directive reflectors have been fitted to some hexagonal lanterns and the results have been extremely satisfactory. New residential roads up to 40 ft. in width are provided with 2 or 3 light gas lamps and small swan necks with 12 ft. cast-iron columns. Of these there are 284 2-light and 102 3-light in use. Of the old 1 and 2 light inverted lamps, now converted to 2 and 4 light, there are 973 2-light and 324 4-light.

Some 19 3-light lamps have been erected on steel columns and 3 ft. brackets; the height to the reflector is 18 ft. and the diagonal spacing on a 50 ft. road is 125 ft. This installation is very pleasing and these lamps give very much

* From a paper before the Association of Public Lighting Engineers, Sept. 6, 1933.

better results than the 14 4-light hexagonal lamps they have replaced. There are 163 4-light lamps in use, of which 28 are centrally suspended and the remainder are on steel columns and brackets. The height to the reflector is from 18 to 22 ft. and the spacing between 110 to 125 ft. diagonal; the width of roads is from 50 to 60 ft.

We consider the 5-light lamp our most useful unit, and it is now being erected on roads which would formerly have been provided with 10, 12, and even 18 light lamps. In the first case the 5-light lamp is used for refuge islands. The mounting is a pylon column fitted with mirrors and amber glass face plates 3 ft. from ground level; the mirrors are adjusted to reflect the light through the amber glass towards the oncoming traffic on either side. Red glass was used at first, but many cases were brought to our notice where this had been mistaken, at a distance, for a rear light of a car. From the fact that amber is an unusual colour to be seen at such a level, it has proved superior to the red formerly used.

Of the 263 5-light lamps in use, 32 are on "refuge islands," 42 are centrally suspended, and the remainder erected on 30 ft. steel poles with 8 ft. brackets; the height of the refletcor is usually 24 ft., and the diagonal spacing varies from 110 ft. to 140 ft. according to the type of road. For instance, Lady Jamshedji Road, a main road leading out of Bombay, is 80 ft. wide between kerb lines, with two footpaths each 20 ft. wide. It has 86 5-light lamps on 8 ft. brackets spaced 110 ft. from pole to pole diagonally. The road surface is concrete with asphalt covering of a greyish colour. The mid span illumination is 0·05 foot-candle, and, thanks to the height of the lamps, the illumination is very evenly distributed and the general impression is most pleasing. The centrally suspended 5-light units are erected 24 ft. 6 in. high to the reflector with a spacing of 125 ft. on a 60 ft. road. The minimum horizontal illumination is 0·025 foot-candle and 0·035 where stainless steel wing reflectors have been fitted. These centrally suspended lamps are in continuation of a stretch of similar units, on 7 ft. brackets, at the same distance apart diagonally and at the same height. It is difficult to say which of the two systems gives the more satisfactory results, for much depends upon the surroundings. Where buildings exist to reflect the light, since most buildings in this City are light colour-washed, the side lighting is certainly superior, but where such reflecting surfaces do not exist, central suspension is desirable. However, generally speaking, the additional capital cost of a centrally suspended system, over lamps erected on brackets and steel columns, is hardly warranted by the results.

I mentioned just now that we considered the 5-light lamp our most useful unit; it is therefore somewhat surprising to find that there are no fewer than 395 6-light lamps in use. The reason for this is that the burners are in two sections of three mantles each, of which one section is extinguished at midnight. These have been erected on new housing schemes and roads likely to develop. The height, spacing, type of brackets, &c., are the same for the 5-light units, but until such housing schemes or roads develop, the lamps are used as 3-lights only. Of the 395 6-light lamps, 296 are at present being used as 3-light lamps. The time has passed in many cases for these to go into full lighting—*i.e.*, 6 lights up to midnight and 3 thereafter, but Bombay, together with the rest of the world, is feeling the trade depression. As trade brightens, so will these roads without additional capital expenditure.

The circle or cluster of mantles in the 6-light lamp of two burners is somewhat less compact than that of the 5-light unit of one burner. It is therefore not surprising that the results from the 5-light units, erected in exactly the same manner, are equal to, if not superior to the 6-light with its less compact cluster. It is astonishing how good the results are from 3 No. 2 mantles at 25 ft. height and 125 ft. spacing, for the illumination, although low, is very uniform and the visibility fairly good.

We have 47 10-light units, in two sections of 5 mantles each, some of which are centrally suspended at junctions to illuminate the traffic control police and for which purpose, erected at from 18 to 22 ft. to the reflector, according to the width of the junction, they are ideal. The remainder are erected on 7 ft. brackets and 30 ft. steel poles at a height of 24 ft. and a spacing of 160 to 180 ft. These, together with our 12 and 18 light, units were erected during the early improvements before we realized the benefit of using smaller units.

Our first centrally suspended gas lamps were erected in 1924. They are 18-light units, of which 12 lights are extinguished at midnight. The road is 60 ft. wide, the height to the reflectors 20 ft. and the spacing 225 to 230 ft. Most people consider this to be an extremely fine installation, but we ourselves regard the results as somewhat patchy, although the use of globes with the bottom sand blasted does much to improve this. Apart from the distribution of light the heavy lantern makes central suspension a difficult and costly matter, and all future installations of centrally suspended lamps will not be larger than 5-light units.

Bombay's principal sea face, Chowpatty, and the main business thoroughfare, Hornby Road, are illuminated with high-pressure gas lamps. The former has 16 1500-c.p. column lanterns in three mantles of 500 c.p. each, 25 ft. to the reflectors and 225 ft. between lamps, and the latter 44 1500 c.p. lamps of three mantles suspended on 8 ft. brackets, height to the reflector 24 ft., and diagonal spacing of 225 and 240 ft. We also have 37 1000-c.p. high-pressure lamps of two mantles each and 20 500-c.p. lamps, principally erected on the roads leading to the aforementioned sea face. One mantle of the 1000 c.p. lamps and two of the 1500 c.p. are extinguished at midnight. The high-pressure lamps have been in use since before the war.

The 12 ft. cast-iron columns used for the lower candle power lamps are 13 ft. 6 in. over-all and are cast in a local foundry. The swan necks for these, including the small castings, the 3 ft. extension pieces for the old 9 ft. columns and the cast-iron base for steel columns, are manufactured in the Gas Company's Works. In the earlier installations they used 30 ft. steel poles, as now, but the bracket was clamped to the pole. Subsequently we realized that by making brackets of galvanized barrel with the upright portion socketed into the pole for a distance of 2 ft. 6 in. and held secure by set screws, the height of the lamp could be raised several feet without material increase in cost; or the same height be obtained with a shorter and consequently cheaper pole. The standard bracket has a 7 ft. projection and all steel columns are provided with cast-iron protection pieces.

All lighting and extinguishing is done by hand. For the hexagonal lamps a wind proof torch, manufactured in the gas-works is inserted in the glass ball trap; a collar on the torch depresses the spiral spring and outer cover, exposing a wick burning cocoanut oil. The length is so arranged that it is not possible to touch the mantles with the wick or torch. Cocoanut oil, when pure, burns practically without smoke or soot, so it is easy to discover the lamp lighter who, for purposes of his own, adulterates the oil issued to him, from the soot marks on the enamelled steel reflectors. The average number of lamps per lighter is 35, and these have to be lighted and extinguished in twenty minutes, that being the difference in time between sunset and complete darkness. Cluster lamps on brackets up to 18 ft. in height are provided with ordinary lever cocks, and the men use light bamboo sticks and ladders.

The lamps over 18 ft., including those centrally suspended, are in fixed positions and are provided with short weighted lever cocks, the weight is approximately 3½ lbs., and the cock is "off" when the lever is almost down. A thin flexible wire is carried from the lever, over two small pulley wheels, and anchored by means of a stud in the side of the column about 8 ft. from ground level. A small ring is attached to the wire, the distance of the lift of the lever cock, above the stud. To light the lamps the ring is placed over the stud which raises the lever cock and holds it in position, and to extinguish, the ring is removed. The wire is taut for "off," while for "on" the tension of the weight is supported by the wire. Lamps of two sections have two such cocks and wires, one each side of the column. For maintenance purposes trolley ladders of the fire escape type which extend to 30 ft. are provided.

Sunset varies from 7.19 in the summer to 6.16 in the winter and sunrise from 5.27 to 6.27, so the shortest night is 10 hours 8 minutes and the longest 12 hours and 11 minutes. The lighting hours per annum total 4051.

The wage of a lamp lighter is equal to £2 5s. per month, this being a little above the rate for unskilled labour. The lamp lighter's job is to light, extinguish, and keep his lamps clean and replace breakages of mantles and globes. Repairs and adjustments are carried out by men of long experience, known as lamp repairers, who are paid somewhat higher wages. The men are at liberty to clean at times most convenient to them; this we find to be better than restricting them to certain hours and lamps each day. We bind the men down to maintaining their lines in good order at all times. During the dry season of approximately nine months, dust accumulates rapidly, and on roads not covered with asphalt a daily dust-over is necessary. The wet or Monsoon season lasts three months, during which we have some 80 in. of rain, which is considerably more than England receives in the whole year. During the Monsoon of 1931 we had over 20 in. in 24 hours. This heavy downpour is usually accompanied by strong wind, and in consequence the rain is driven horizontally, thus striking the globes at the hottest point, which in the ordinary way is protected by the reflectors. Only the very best heat-resisting glass will stand up to these conditions, and, even so, many globes crack in a straight line, as though cut with a diamond cutter.

However, the Monsoon, uncomfortable as it is, is not the

lamp lighter's most troublesome season, for it is followed by a period of light showers and sunshine, which is marked by plagues of insects. Our worst enemy, whose special mission on earth, it would appear, is to break gas mantles, is a very small hard bug, which is able to fly in and out of a mantle several times before passing over to, I hope, a warmer climate. In one such period we issued six months' stock in two days, but that was an exceptionally bad year and was followed by a year of comparative freedom.

Despite these setbacks, the average life of the No. 2 mantles throughout the year is 3·15 months, the longest life is 4·5 months in the dry season, and the shortest 2·2 during the insect period.

" Langlands " two point fitting No. 2 size mantles only are used for public lighting, and it is not possible for the public to obtain the nozzles or mantles of this type, with the result that, when first introduced, some years ago, we saved 30% mantles from the fact that these were of no use to the tea shops frequented by the lamp lighters.

At the commencement of this paper I said I was sorry that the population of Bombay did not always live amicably. Communal riots occur far too frequently and are usually the result of some trifling incident. For instance, a small affair in which some eight persons were killed and some fifty injured this year in January, was caused through a Mahomedan being accidentally struck in the face by a cricket ball hit by a Hindoo youth in a public recreation ground. The promptness of the police measures prevented this assuming the proportion of the riots we passed through in 1932. During these times the public lighting is the most difficult, and, at the same time, one of the most important, of public services, without which the police and military would be considerably handicapped and the ruffian element encouraged. For these reasons the public lamps are the first to be damaged, and a noticeable feature of all riots is the fact that in many streets the residents hang lamps from the third or fourth floors, these being not so easily broken as the ordinary street lamps, and, as the ruffians are scared of subsequent identification, streets so illuminated are comparatively free from looting, &c. The Public Lighting Department of the Bombay Gas Company embodies roughly 40% Hindoos, 40% Mahomedans, and 20% Christians, and as it is not safe at such times for a Hindoo to pass through or even near a Mahomedan locality, and *vice versa*, the repairing, lighting, and extinguishing requires the most careful organization. Briefly the system is as follows, but it necessarily varies according to the nature and seriousness of the trouble. Fortunately the men live in two areas, the Hindoos near the gas-works and the Mahomedans some four miles away, in which, being among their own kind, they are able to gather together. The European business quarter and the better class residential areas are not usually affected, and the men for these areas are conveyed by lorries and left to carry on. The remainder are conveyed and left in small groups at safe places such as police posts, military pickets, or where rioting does not usually occur. This is done before lighting time, which is advanced an hour or so according to the seriousness of the situation. These small groups then carry out the work in the roads occupied by their own community, or where it can be done safely. Meanwhile the lorries and other cars conveying the staff visit each post and escort the men where required. On receiving the report that all work has been completed, the lorries reverse the procedure, and the men are conveyed back to their respective areas.

Despite every precaution, men have been injured chiefly from stray stones or soda water bottles (which is a favourite missile!), but, in 1932, a lorry conveying Hindoos was attacked by Mahomedans. Two Hindoos were seriously injured by stabbing, and also the Mahomedan driver, on the grounds that he could not be a true Moslem for conveying such men. Despite the difficulties and danger the men are brave and loyal, and it is to their credit that so far the public lighting has carried on when most other public services have been at a standstill. During these times the staff are lucky to obtain any rest, for when the day's routine work is completed, complaints of lamps not lit (usually found to be broken beyond immediate repair) and men missing from their homes are received over the telephone at all hours and must receive immediate attention.

NOTES ON PLANT AND PROCESSES

Gas Fires for 1933-34.

Cosy and cheerful warmth, always under complete control and providing perfect ventilation of the apartment, is available to those who install Main gas fires; and the new season's catalogue, just issued by Messrs. R. & A. Main, Ltd., of 48, Grosvenor Gardens, S.W. 1, shows that there are types to suit any type of room, and finishes to harmonize with any decorative scheme.

A beautifully coloured front cover design, representing an up-to-date gas fire in a modern setting, sets the standard for what follows within, and it is of note that the extensive choice of Main gas fires steadily increases year by year the popularity of these appliances. Attractive representations in colour of various models of fire help to show just what the fire will look like in the home, and give some idea of the many designs and finishes available.

At the outset the catalogue describes the advantages of the " Raymain " radiant, which, it is stated, has advantages over other types in that it heats up rapidly and gives a brilliant incandescence. Its warmth is smooth, comfortable, and inviting, and the heat waves from it are able to penetrate the surface of the human skin and warm the blood stream just like the heat of the sun. The new " Duramain " radiant is a great asset in the maintenance of gas fires. It is made of superior material by an entirely different process to that of the usual fireclay radiant, and it is definitely claimed not to break during ordinary use.

The latter radiant is embodied in the design of the firm's latest development in gas fires—the " Crichton." This fire invites attention on account of its modern lines, and also because of its outstanding advantages in providing efficient and effective heating. The " Crichton " has a minimum projection from the grate or panel to which it is fitted. The extra height and the curved form of its " Duramain " radiants promote longer flame travel and a greater radius of heat—upwards and downwards as well as horizontally. The fire can either be built in flush to a tiled surround or fitted in front of an existing coal interior.

Other series of gas fires are dealt with in the catalogue, and a range of mantels is also illustrated, complete with hearth and all ready to be fitted into the wall opening, while similar units with " Manu-Marble " surrounds are shown, these mantels being available in a variety of colours. In addition, the catalogue devotes sections to the popular " Romain " panel heater, full details of which are given, together with the " Unimain " steamless radiator and the " Cinemain " safety radiator, which is specially suitable for picture houses, factories, schools, public institutions, &c. Finally, a useful chart is given, to enable the size of fire suitable for any particular floor area to be determined.

New Patching Cement.

A new cement has been put on the market, and it is claimed that the product has all the essential qualities for hot patching considered necessary by the Joint Refractory Materials Research Committee. It is suitable for either cold or hot repair, is plastic, and can be used with a trowel, " gun," or paddle; and it can be reduced with water for dipped joints or spraying. The raw materials have a softening point of 1670° C., as also has the finished product —known as " E. B. Patch." The first sign of glazing at the corners of the patch is Cone 28 (1630° C.). The stickability is such that a cone of half-an-inch area will lift a 9-in. brick.

The new cement is manufactured by the E. B. Refractory Cement Company, Ltd., 147, Corporation Street, Birmingham.

Drayton Measuring Instruments.

The Drayton Regulator and Instrument Company, Ltd., of West Drayton, Middlesex, have acquired the exclusive manufacturing licence for the British Empire for instruments manufactured by Union Apparatebau m.b.H. Karlsruhe i.B. These instruments comprise a range of indicators and recorders for very light pressures, simple and differential, volume, density, and heat value.

A booklet has been issued by the firm giving particulars of the " Union " type control instruments, all of which employ the liquid sealed balance principle, and according to the pressure (or vacuum) to be measured, the balances are either formed of inter-communicating large-diameter cylindrical glass vessels or of glass ring tubes.

In instruments for lowest pressure (0-5 mm.) the pressure

is introduced into the measuring device through liquid seals which eliminate even the small amount of friction caused by specially flexible rubber tube connections, which are used for the higher pressures. In all instruments the indicating pointer or recording pen arm is directly attached to the balance beam—magnification being obtained solely by the pointer or pen arm length—no friction being introduced by magnifying mechanism. Ring balance instruments, while extremely sensitive to the smallest permanent variation of pressure, possess sufficient inertia not to be affected by pulsations.

Drayton " Union " type glass ring balance instruments cover a pressure range from 0-5 to 0-3060 mm. W.G., while volume measuring instruments can be fitted with an ingenious device so that volume charts are evenly divided. For test instruments which may have to measure, at times, very small volumes, special orifice fittings are available covering 3 to 4 volume ranges with uniform accuracy.

The booklet is devoted to the application of Drayton " Union " type measuring instruments for density, vacuum, and pressure control in gas-works.

Ideal Radiators and Boilers.

A useful and attractive catalogue recently published by the National Radiator Company, Ltd., of Hull, contains complete particulars and illustrations of all current Ideal radiators and Ideal boilers, including certain new designs which have been introduced by the firm.

It is of interest to note that all Ideal radiators and boilers are subjected to a hydrostatic test pressure of 100 lbs. per sq. in., and are guaranteed to the extent of furnishing new parts for any found defective in manufacture. The firm's laboratory at Hull is equipped with the most modern recording instruments, enabling rigid and accurate tests to be made, which, combined with the use of best materials and manufacturing methods, ensure the utmost efficiency and reliability of the appliances.

The catalogue contains a comprehensive index, together with useful information on the assembling of radiator parts, while further sections of this 200-page publication are devoted to particulars of Ideal towel rails, boiler accessories, valves, pipe fittings, tools, &c.

Testing Radiant Efficiency of Gas Fires

The apparatus shown in the accompanying illustration is a bolometer outfit, designed by the Cambridge Instrument Company, Ltd., of 45, Grosvenor Place, London, S.W. 1, for testing the radiant efficiency of gas fires. The equipment includes a metal table, on which the gas fire to be tested is positioned. The table is fitted with an iron frame having a large semi-circular bar arranged to form an equatorial mounting for the receiving element of the bolometer; the bar is fitted with alternative positions along the semi-circle for the receiver, and alternative angular positions for the bar are arranged on the frame, so that the bolometer can measure the radiant heat in 81 equidistant areas in front of the fire. The working radius of the receiver is 36 in.

The receiving element, shown attached to the centre of the semi-circular bar at the right of the illustration, consists of two exactly similar flat coils of platinum wire, wound on mica plates and mounted on the two ends of a cylindrical support. The platinum coils are blackened to secure more complete absorption of the radiation, and caps are provided for the two ends of the cylinder so that either coil or both may be shielded from radiation. The central portion of the cylinder is made hollow and provided with inlet and outlet tubes so that a stream of water may be passed through for the purpose of maintaining a uniform temperature. The two platinum coils are connected to form two arms of a Wheatstone bridge circuit, the ratio arms of the bridge and the galvanometer being contained within the case of the portable indicating instrument, shown in the left in the illustration. Since the two platinum coils are exactly similar, there will be no deflection of the galvanometer when neither is exposed to radiation. A rise in temperature of either coil due to radiation falling upon it will throw the bridge out of balance and cause a deflection of the galvanometer, which is a pivoted moving coil instrument. The indicator is calibrated to read directly in calories, the range being 0-30 kilocalories per sq. ft. per hour. Full-scale deflection corresponds to a rise in temperature of about 13° C. on the exposed side. The range may be increased by cutting out resistance in definite steps from the arm of the bridge in which the exposed coil of the bolometer is connected. This adjustment, which is carried out by means of terminals on the indicator case, enables ranges of 30-60, 60-90, and 90-120 kilocalories per sq. ft. per hour to be obtained. A 2-volt accumulator provides the current for the bridge circuit.

The " equatorial " form of mounting employed is based upon a suggestion made by the late Prof. H. A. Callender. It has been found highly effective for testing the radiation of gas, coal, and electric fires, a high order of accuracy being obtained.

REGISTER OF PATENTS

Automatic Neutralizing Control.—No. 389,601.

W. C. Holmes & Co., Ltd., Cooper, C., and Henshaw, D. M., all of Huddersfield.

No. 552; Jan. 8, 1932.

This invention relates to a process in which the gas is continuously treated with an alkaline or an acid reagent as the case may be. The object is to provide a method of control which is automatic. This is effected by treating the gas so as to obtain successive portions of liquid which will contain a proportion of any acid or alkaline substance which may still be present in the gas, adding an indicator to such portions, directing upon such portions a beam of light of a colour selected to pass through the liquid in one at least of the colour states of the indicator but to be absorbed by the liquid in one other at least of the colour states of the indicator, and causing the light transmitted through the liquid to actuate a photo-sensitive device adapted to control the supply of alkaline or acid reagent to the gas. Thus the photo-sensitive device may consist of a photo-electric cell which may control a valved supply of reagent through suitable relay mechanism.

The gas is preferably continuously treated with the reagent in fixed supply definitely insufficient for neutralization and also in variable supply adapted to be controlled by the photo-sensitive device. Where the gas, at least after treatment with the reagent, contains water vapour, a portion of this may be periodically or continuously condensed by cooling to give the portions of liquid to which the indicator is to be added continuously or periodically.

The invention can be applied with advantage to the process of neutralizing the acidic constituents such as oxides of sulphur in gases by means of aqueous alkali, more especially the neutralization of the acids in flue gases, for example by means of aqueous ammonia.

Preferably the ammonia liquor fed in to the system is controlled partly by a continuous feed which is definitely insufficient to neutralize all the oxides of sulphur and partly as a variable feed controlled by the relay of a photo-electric cell.

A portion of the outgoing flue gases is passed through a condenser, and to the condensate is added a definite proportion of a solution of bromo-thymol-blue by a slow constant feed. The coloured solution is then allowed to flow continuously through a small glass cell which need be only of a few cubic centimetres capacity and having plain glass faces about 1 cm. apart. A parallel beam of yellow light is then passed through the cell and allowed to fall upon a photo-electric cell. This beam is preferably obtained from an intense source of light by the aid of a colour filter adapted to pass light within a moderately narrow band of wave lengths in the neighbourhood of 620$\mu\mu$, which corresponds to the absorption band of alkaline bromo-thymol-blue. When the indicator is in the blue condition, practically no light passes. A small departure from green to yellow causes a great increase in the amount of light falling on the cell; and the increase in current delivered from the cell, after amplification by a thermionic valve, is caused to actuate a relay operating a magnetic valve control on the variable ammonia feed, thus delivering more ammonia liquor to the system. The device is adjusted to work at the correct colour by adjustment of the relay or of the high tension current applied to the cell, or both. A balanced relay which operates with small changes of current at any particular total current is preferably used.

Prepayment Mechanism.—No. 390,261.

Meters, Ltd., of Manchester, and Barlow, G., of Oldham.

No. 34,452; Dec. 12, 1931.

This invention concerns prepayment meters adapted to receive coins of different denomination, at the option of the purchaser.

There is a casing with vertical annular wall closed by a removable cover or price-change disc having a single coin slot therein. The cover carries a lower rotatable plate with means pendent from the latter to receive and actuate coins of different denominations. Within the casing there are located two superposed toothed measuring wheels of different diameter, each combined with a lower disc, with one of which measuring wheels an inserted coin is adapted to engage and rotate. The measuring wheels are arranged to operate as requisite through combined and proportionate gear wheels the mechanism which opens the gas valve in the meter to an extent commensurate with the value of the coin or coins inserted, the gas valve being gradually closed as the gas is consumed.

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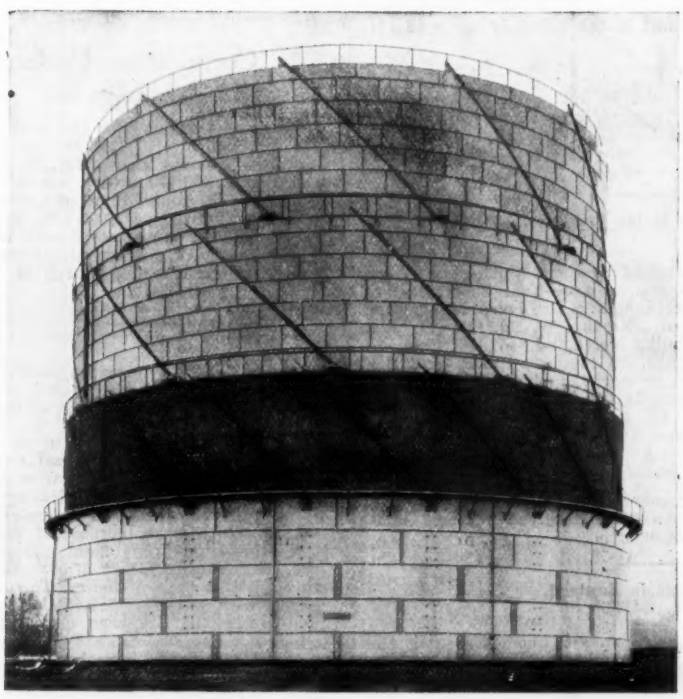

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GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

The new account opened on the Stock Exchange last week in a somewhat depressed state, with sellers predominating in many sections and consequent reductions in prices. By Tuesday, however, markets displayed a brighter tone, the special feature being the strength of British Funds and other trustee stocks for which large buying orders were received. These conditions continued throughout the remainder of the week, which closed optimistically.

The Gas Market was again strong and showed a number of rises. Ordinary stocks are still in big demand, and in almost every case, even where the quotation remained unchanged, the prices of recorded transactions were higher than those of the previous week. Barnet ordinary headed the list of increases with a gain of 6 points to 162½, business being done at 165. Inquiries for East Surrey ordinary took the price up 5 points to 127½; South Suburban ordinary was active and rose 3 points to 127½; the Hong Kong and China new £1 shares advanced 2s. to 31s.; while at the local Exchange Newcastle units gained a further 3d. to 25s.

The supply of ordinary stocks is still comparatively small, though at the time of writing there is on offer £3000 Tottenham ordinary at 150, yielding, on a 6¾% basis, £4 10s.%. Slightly higher yields are usually obtainable on the stocks of the smaller undertakings. Among these on offer are £305 Haslemere 10% maximum at 208 yielding £4 16s. 2d., and £646 Holyhead and North Wales Gas and Water £1 shares at 16s. 6d., at which price the yield on a 4% basis works out at £4 17s.

There is more choice among perpetual debentures, and those on offer giving the highest yield include a small parcel of Plymouth 5% at 115 yielding £4 7s. £600 Wellington (Salop) 5% is offered at 117 to give £4 5s. 6d., and £800 Barnsley 5½% at 130 yielding £4 4s. 7d.%.

(Hong Kong—Correction from Official List. In the list of transactions for last week the business marked at 28s. should have been 28s. 9d.)

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *Sept.* 18.

There are no changes to report in the prices of tar products, which remain as follows:

Pitch. 80s. per ton f.o.b.

Creosote, 3d. per gallon.

Refined tar, 4d. to 4½d. per gallon in bulk at makers' works.

Pure toluole is about 2s. 9d.; pure benzole, 1s. 9d.; solvent naphtha, 95/160, is steady at 1s. 7d. to 1s. 8d.; and 90/140 pyridine bases is 4s. 3d. to 4s. 6d.—all per gallon naked at makers' works.

Tar Products in the Provinces.

Sept. 18.

The average prices of gas-works products during the week were: Gas-works tar, 30s. to 35s. Pitch—East Coast, 72s. to 75s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 72s. to 75s.* Toluole, naked, North, 1s. 9d. to 1s. 10d. Coal-tar crude naphtha, in bulk, North, 6d. to 6½d. Solvent naphtha, naked, North, 1s. 5½d. to 1s. 6d. Heavy naphtha, North, 10d. to 11d. Creosote, *ex* works, in bulk, North, liquid and salty, 2d. to 2½d.; low gravity, 2d.; Scotland, 2d. to 2½d. Heavy oils, in bulk, North, 4d. to 4½d. Carbolic acid, 60's, 2s. 7½d. to 2s. 9d. Naphthalene, £9 to £10. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2½d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Sept.* 16.

Prompt supplies of many products are quite scarce in this district, and prices are firm with tendency upwards.

Crude gas-works tar.—The actual value is 40s. to 45s. per ton *ex* works.

Pitch.—Demand is poor with prices easy. Export value is round 70s. per ton f.o.b. Glasgow. For home trade 72s. 6d. to 75s. per ton *ex* works is quoted.

Refined tar to Ministry of Transport Specification is on offer at 3½d. per gallon f.o.r. in bulk.

Creosote oil continues scarce for prompt, but little new business is on hand and prices are unchanged. B.E.S.A. Specification is 3d. to 3¼d. per gallon; low gravity, 3d. to 3¼d. per gallon; and neutral oil, 3d. to 3¼d. per gallon—all in bulk *ex* works.

Cresylic acid shows some improvement, and makers are holding for better prices. Actual values are unchanged. Pale, 97/99%, is 11d. to 1s. per gallon; dark, 97/99%, 9d. to 10d. per gallon; and pale, 99/100%, 1s. 2½d. to 1s. 3½d. per gallon—all f.o.r. in buyers' packages.

Crude naphtha.—Supplies are short and value is 4¼d. to 4¾d. per gallon *ex* works in bulk, according to quality and quantity.

Solvent naphtha.—90/160 grade is 1s. 4d. per gallon, and 90/190 heavy is 1s. per gallon.

Motor benzole.—Only small quantities are available at 1s. 5d. per gallon *ex* works.

Pyridines.—90/160 grade is 3s. to 3s. 3d. per gallon, and 90/140 grade 3s. 3d. to 3s. 6d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole	0	9	to	0	9½	per gallon at works
Motor ,,	1	4	,,	1	4½	,, ,, ,,
Pure ,,	1	7½	,,	1	8	,, ,, ,,

Trade Notes.

Contract for Klönne Holder.

We learn from Dry Gasholders, Ltd., that their German Licensors, Messrs. Aug. Klönne, have secured an order for a Klönne waterless gasholder of 6 million c.ft. capacity for the Mine Minister Stein at Dortmund.

Corporation Undertakings' Results.

Oldham.

The gross revenue for the year amounts to £289,236 and the gross expenditure to £241,983, the credit balance carried to profit and loss account being £47,252. The net loss on the year's working is £10,170, which has been increased by the contribution to the Borough Fund of £4000, to the sum of £14,170. The net price realized per 1000 c.ft. of gas sold during the past year was 3s. 4·51d., as compared with 3s. 3·02d. in the year previous. The quantity of gas manufactured at the different gas stations during the year ended March 31, 1933, was:

	C.Ft.		Therms.
Oldham gas station	217,166,000	..	1,029,367
Higginshaw ,,	774,609,000	..	3,694,885
Hollinwood ,,	607,108,000	..	2,883,763
,, ,, (water gas plant)	..	..	..
	1,598,883,000	..	7,608,015

The amount of coal used in its production was 92,557 tons. The average quantity of coal gas made per ton of coal carbonized during the past year was 17,273 c.ft., or 82·2 therms, as compared with 17,108 c.ft., or 81·2 therms, in the previous year. The total number of meters fixed on March 31 last was 63,875, which is an increase of 460 as compared with last year. The number of prepayment meters in use has increased during the year from 35,751 to 37,093. The quantity of gas consumed through this type of meter amounted to 659,443,300 c.ft., compared with 694,311,200 c.ft. last year, and from this type of meter £124,401 has been collected during the twelve months, which is a decrease of £305 compared with the previous year. A total of 581 meters have been fixed in new premises and others in which gas was not previously used, and 121 meters have been permanently disconnected. The actual number of consumers on March 31 last was 58,333.

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf.-Yr. % p.a.	Dividends. Last Hf.-Yr. % p.a.	NAME.	Quotations. Sept. 15.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
1,551,868	Stk.	Apl. 3	7⅞	7	Alliance & Dublin Ord. ...	120–130	...	123
374,000	,,	July 10	4	4	Do. 4 p.c. Deb. ...	85–95	...	93½
557,655	,,	Aug. 28	7	7	Barnet Ord. 7 p.c.	160–165	+6	157½–165
300,000	1	May 8	1/4⅛	1/9⅜	Bombay, Ltd.	26/–27/-	...	...
178,280	Stk.	Aug. 14	9½	9½	Bournemouth sliding scale	192–202	...	...
550,050	,,	,,	7	7	Do. 7 p.c. max. ...	163–168	...	166⅔
439,160	,,	,,	6	6	Do. 6 p.c. Pref. ...	135–140	...	140
50,000	,,	June 26	3	3	Do. 3 p.c. Deb. ...	74–79	...	...
162,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	99–104	...	174
210,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	120–125	...	...
357,900	,,	Aug. 28	7½	7½	Brighton, &c. 6 p.c. Con. ...	157–167	...	...
540,000	,,	,,	6⅔	6⅔	Do. 5 p.c. Con. ...	143–148	...	145½–148
195,500	,,	,,	6	6	Do. 6 p.c. B Pref.	134–139	...	1.84
1,487,500	,,	July 24	5	5	Bristol 5 p.c. max.	111–112*a*	...	...
12?,420	,,	June 26	4	4	Do. 1st 4 p.c. Deb.	99–101*a*	+½	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	99–100*a*	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	119–122*a*	...	...
855,000	,,	Apl. 3	7	8	British Ord.	167–162	...	158–159½
100,000	,,	June 26	7	7	Do. 7 p.c. Pref.	145–150	...	...
350,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	108–113	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	94–99	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	103–113	...	...
160,000	,,	June 26	5	5	Cambridge 5 p.c. Deb. ...	115–120	...	...
100,000	10	May 22	6	4	Cape Town, Ltd.	7–8	...	...
100,000	10	Apl. 24	4½	4½	Do. 4½ p.c. Pref. ...	7–8	...	...
150,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. ...	93–98	+1	95–97
626,860	,,	July 24	6	6	Cardiff Con. Ord.	117–122	...	...
237,860	,,	June 26	5	5	Do. 5 p.c. Red. Deb.	105–110	...	...
157,150	,,	Aug. 14	6½	5	Chester 5 p.c. Ord.	105–110	...	...
98,936	1	May 22	2/-	2/-	Colombo, Ltd. Ord.... ...	1½–1⅝	+⅛	31/3–32/6
24,500	1	,,	1/4⅛	1/4⅛	Do. 7 p.c. Pref. ...	18/6–20/6	...	...
609,204	1	Mar. 20	/11 48	/11 48	Colonial Gas Assn. Ltd. Ord.	17/6–20/-	...	...
296,053	1	,,	1/3·30	1/3·30	Do. 8 p.c. Pref.	1⅛–1½	+1/20	24/4½
1,796,955	Stk.	July 24	6½	5	Commercial Ord.	115–120	...	...
475,000	,,	June 12	3	3	Do. 3 p.c. Deb. ...	73–78	...	76½
265,272	,,	Mar. 6	—	5	Do. 5 p.c. Deb. ...	120–125	...	...
807,560	,,	Aug. 14	7	7	Croydon sliding scale ...	143–148	...	146–147
469,590	,,	,,	5	5	Do. max. div.	103–108	+2	105–107
500,000	,,	July 10	5	5	Do. 5 p.c. Deb.	120–125	...	121½
542,270	,,	Mar. 6	7	10	Derby Con.	155–165*c*	...	...
55,000	,,	July 10	4	4	Do. 4 p.c. Deb.	93–98*c*	...	...
209,000	,,	Aug. 28	5	5	East Hull Ord. 5 p.c. ...	105–110	...	...
179,500	,,	Aug. 28	6	6	East Surrey Ord. 5 p.c. ...	125–130	+5	...
155,019	,,	June 26	5	5	Do. 5 p.c. Deb. ...	117–122	...	...
1,002,180	,,	Apl. 3	15	17	European, Ltd.	142–147	...	145–47
19,373,992	,,	Aug. 14	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	26/3–27/3*f*	...	26/7¼–27/1¼
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	83–86	...	85–85⅝
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	100–103	...	101¼–.02½
6,102,497	,,	June 12	3	3	Do. 3 p.c. Con. Deb. ...	77–80	...	78¾–80
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	115–118	...	...
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	113–116	...	113½–114⅝
270,466	,,	Aug. 28	6	6	Harrogate New Cons. ...	120–125	...	...
82,500	,,	Aug. 28	7	7	Hastings & St. L. 5 p.c. Conv.	135–140	...	...
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	108–113	...	112–113
140,000	1	Apl. 24	110	110	Hongkong & China, Ltd. ...	30/- –32/-	+/-	29/6–31/-
218,200	Stk.	Aug. 14	6	6	Hornsey Con. 5½ p.c. ...	120–125	...	...
5,600,000	,,	May 22	10	14	Imperial Continental Cap.	223–233	–2	224–230
223,130	,,	Aug. 14	3½	3½	Do. 3½ p.c. Red. Deb.	89–94	...	...
235,242	,,	Aug. 14	8½	8½	Lea Bridge 5 p.c. Ord. ...	167–172	...	...
2,145,907	,,	Aug. 14	6	6	Liverpool 5 p.c. Ord. ...	125¼–126½	...	...
245,500	,,	June 26	5	5	Do. 5 p.c. Red. Pref. ...	103–113⅝	...	...
306,083	,,	July 17	4	4	Do. 4 p.c. Deb. ...	99¼–101⅛	...	...
165,736	,,	Aug. 28	10	8	Maidstone 5 p.c. Cap. ...	177–189	...	...
56,176	,,	July 10	3	3	Do. 3 p.c. Deb. ...	69–74	...	...
75,000	5	June 12	110	110	Malta & Mediterranean ...	9–11	...	10⅛
392,000	—	Apl. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	98–103	...	...
231,978	Stk.	Aug. 28	5	5	M. S. Utility "C." Cons. ...	110–115	...	112¼–113½
818,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	91–96	...	96
112,126	,,	June 26	4	4	Do. 4 p.c. Deb. ...	100–102	...	102
148,955	,,	,,	5	5	Do. 5 p.c. Deb. ...	118–118	...	...
675,000	,,	21 May '31	16	16	Montevideo, Ltd.	55–65	...	55–55⅞
2,061,315	,,	Aug. 14	5½	5	Newcastle & Gateshead Con.	24/6–25/6*d*	+·/8	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	98–100*d*	...	...
776,706	,,	July 10	3½	3½	Do. 3½ p.c. Deb. ...	91–93*d*	...	...
277,285	,,	May 8	5	5	Do. 5 p.c. Deb. '43...	107–109*d*	...	...
274,000	,,	Aug. 14	5	5	Newport (Mon.) 5 p.c. max.	100–102*a*	...	...
204,940	,,	Aug. 28	7½	7½	North Middlesex 6 p.c. Con.	144–152	...	...
396,160	,,	Aug. 14	5	5	Northampton 5 p.c. max. ...	101–106	...	...
300,000	,,	Apl. 24	9	7	Oriental, Ltd.	114–119	...	...
316,617	,,	June 26	8	8	Plym'th & Ston-house 5 p.c.	166–171	...	...
504,416	,,	Aug. 28	8	8	Portsm'th Con. Stk. 4 p.c. Std.	158–163	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	102–107	...	...
114,000	,,	Aug. 14	5	5	Preston 5 p.c. Pref.	101–106	...	...
686,312	,,	July 24	4	4	Primitiva 4 p.c. Rd. Db. 1911	86–91	...	...
389,813	,,	June 26	4	4	Do. 4 p.c. Cons. Deb.	82–87	...	...
150,000	10	Mar. 20	6	6	San Paulo 6 p.c. Pref. ...	6⅞–7⅛	...	...
1,736,968	Stk.	Sept. 11	6	6	Sheffield Cons.	127–130*e*	...	...
95,000	,,	July 10	4	4	Do. 4 p.c. Deb.	90–94*e*	...	...
133,201	,,	Sept. 11	5	8½	Shrewsbury 5 p.c. Ord. ...	132–137*	–3	...
90,000	10	June 12	15	14	South African	3–5	...	...
6,709,895	Stk.	Aug. 14	7	5	South Met. Ord.	126–131	...	129–131½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	134–139	...	136½–138
850,000	,,	,,	20/-*g*	4	Do. 4 p.c. Irred. Pf.	99–103	...	102½–102½
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb. ...	76–79	...	...
1 000,000	,,	July 24	5	5	Do. 5 p.c. Red. Deb.	112–116	...	...
209,820	,,	Aug. 14	8½	8½	South Shields Con.	146–148*d*	...	...
1,543,795	,,	Aug. 14	6	6	South Suburban Ord. 5 p.c.	125–130	+3	126–129
300,000	,,	,,	5	5	Do. 5 p.c. Pref.	112–117	+1	115
300,000	,,	,,	—	4	Do. 4 p.c. Pref.	93–103	...	...
868,837	,,	June 26	5	5	Do. 5 p.c. Deb.	118–123	...	123
100,000	,,	‡	—	—	Do. 4 p.c. Deb.	102–105	...	...
647,740	,,	Aug. 28	5	5	Southampt'n Ord. 5 p.c. max.	‡107–112	+1	109
121,275	,,	June 26	4	4	Do. 4 p.c. Deb.	99–104	...	101
350,000	,,	Aug. 28	5½	5½	Swansea 5½ p.c. Red. Pref.	107–111	...	...
200,000	,,	June 26	6½	6½	Do. 6½ p.c. Red. Deb.	103–108	...	...
1,076,490	,,	Aug. 14	6⅔	6⅔	Tottenham and District Ord.	145–150	...	147½–150
300,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	121–126	...	...
62,235	,,	,,	5	5	Do. 5 p.c. Pref. ...	108–113	...	...
199,005	,,	June 12	4	4	Do. 4 p.c. Deb. ...	96–101	...	100
85,701	,,	Apl. 3	6	6	Tuscan, Ltd., 6 p.c. Red. Db.	80–85	...	...
347,769	,,	Aug. 28	7	7	Uxbridge, &c., 5 p.ct. ...	144–149	...	...
88,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	108–113	...	...
1,322,220	,,	July 10	7	7	Wandsworth Consolidated	145–150	...	150
1,096,373	,,	,,	5	5	Do. 5 p.c. Pref.	113–118	...	116
1,317,964	,,	June 26	5	5	Do. 5 p.c. Deb.	118–123	...	...
158,400	,,	Aug. 28	6A	5	Winchester W. & G. 5p.c. Con.	107–112	...	...

Quotations at:—*a.*—Bristol *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock. *g.*—For quarter. *h.*—Paid £3, including 10*s.* on account of back dividends. ‡ The interest due 1/7/33 was paid on that date. *Ex. div. † Paid free of income-tax. ‡ For year. Honskong & China, Ltd—paid on £10 shares.

COMPANY NOTICES.

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NOTICE is Hereby Given that the TRANSFER BOOKS of the ORDINARY STOCK of this Company WILL BE CLOSED from the 20th of September to the 3rd October, both days inclusive.

By order of the Court of Directors,
A. J. MUMFORD,
Secretary.

Chief Office,
No. 2, The Abbey Garden,
Westminster, S.W. 1,
Sept. 16, 1933.

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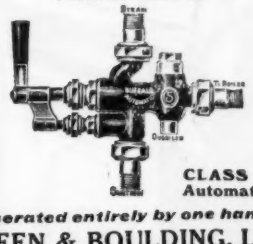

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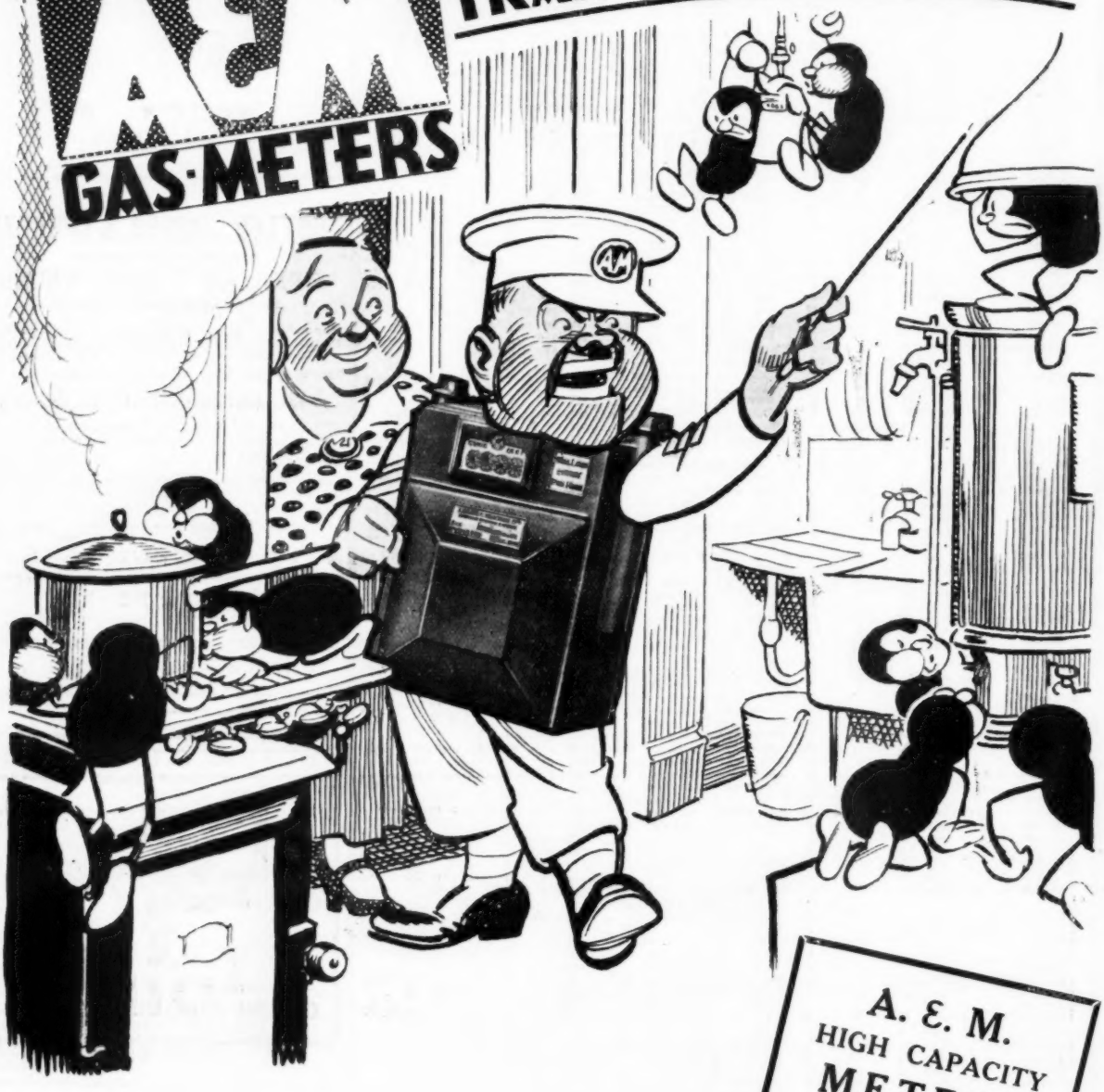

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See "JOURNAL," September 13, p. 581.

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AN ABSOLUTELY STANDARD PRODUCT.
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As supplied to most of the Principal Gas Works in Great Britain.

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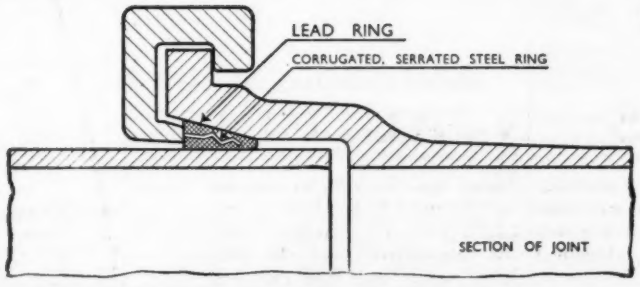
The STANTON Mechanical Lead Joint

(Patent applied for)



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This mechanically made joint works on a similar principle to the Stanton-Wilson Joint, but employs a lead ring in which is encased a thin corrugated, serrated steel ring. It is more flexible than a caulked joint and provides for expansion and contraction of mains—No skilled labour needed.

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APPLICATIONS are invited for the Position of ENGINEER and MANAGER to the above Company.

Applicants must produce a First-Class Health Certificate, and must have had a good sound Technical Training and Practical Experience in Modern Methods of Manufacture and Distribution of Gas. Knowledge and Experience with Horizontal Retorts, Stoking Machinery, and Electrical Plant is essential. The Applicant must also have Experience of Competition with Electricity and Oil, and Commercial Ability is most desirable.

Commencing Salary, £600 per Annum, rising to £700 by annual increments of £25.

Age not to exceed 40.

Applications, stating Age, and giving full details of Training, Qualifications, and Experience, accompanied by *copies* of Three recent Testimonials, must be sent to the undersigned not later than Saturday, Sept. 23, 1933. Envelope to be endorsed "Engineer and Manager."

A. NORMAN,
Secretary.

Gas Offices,
Ilfracombe,
Aug. 31, 1933.

BOROUGH OF HEYWOOD (LANCS.).

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Applicants must possess extensive knowledge and experience of Modern Gas Manufacture and Supply in all phases, including Vertical Retorts and Carburetted Water Gas Plant, and must be capable of undertaking all classes of Constructional Work connected with a Gas Undertaking, and must also possess sound Commercial Experience.

Applications (stating Age, present and previous Appointments, Qualifications and Experience, and accompanied by *copies* of Three Testimonials) must be received by the undersigned not later than Wednesday, the 27th September, 1933, endorsed "Gas Engineer and Manager."

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JAMES TAYLOR,
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Sept. 18, 1933.

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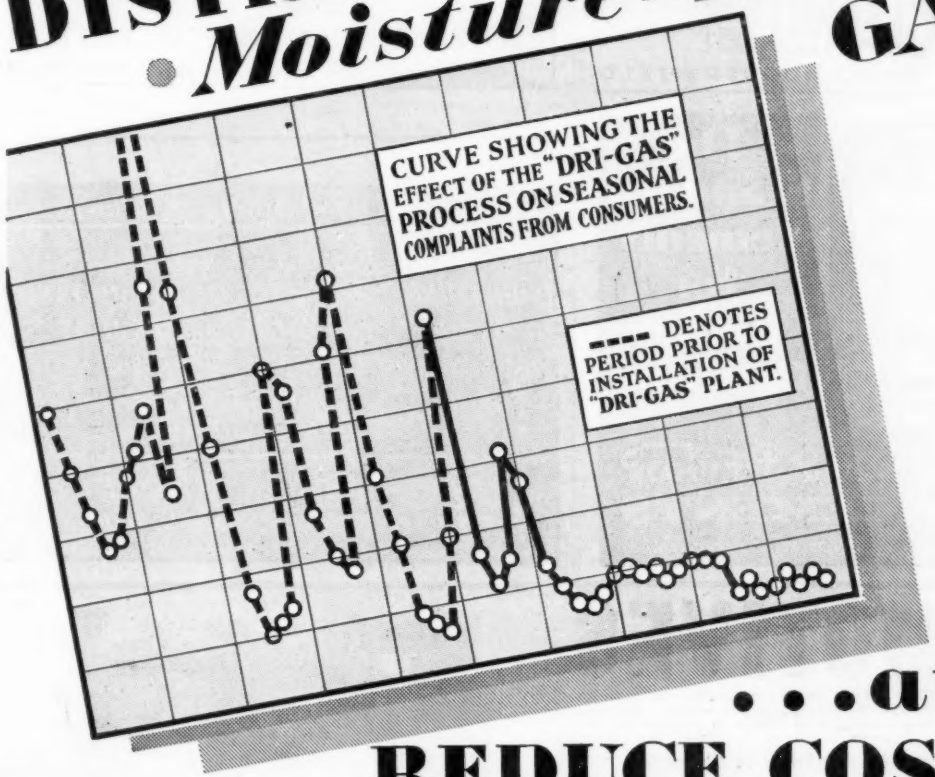
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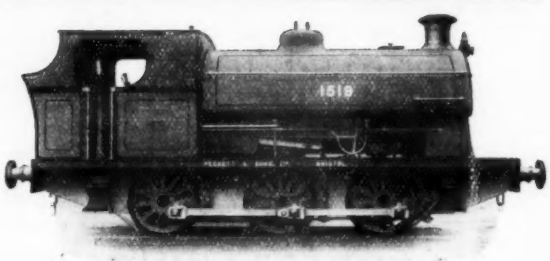

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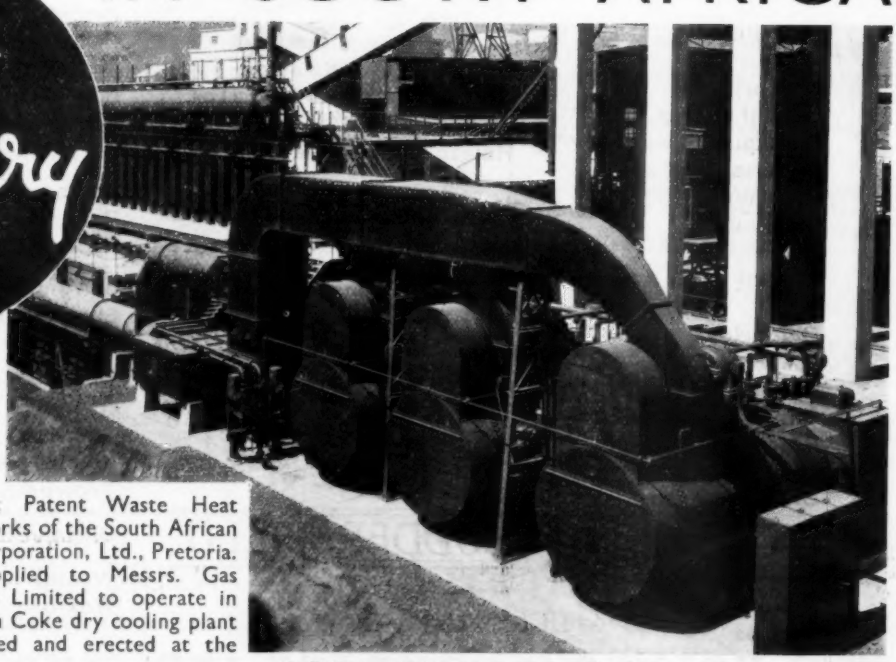

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INDEX TO "JOURNAL" ADVERTISERS.

A

PAGE

Abbott, Birks, & Co. 602
Aerograph Co., Ltd. . . . . —
Alder & Mackay, Ltd. 634
Allan, Thomas, & Sons, Ltd. . . . 633
Amal, Ltd . . . . . —
Anglo-American Oil Company, Ltd. —
Arden Hill & Co. . . . . —
Asbestos Cement Building Products, Ltd. . . . . —
Ashmore, Benson, Pease, & Co., Ltd. Wrapper I.
Ashworth & Parker 636
Assessment of Gas Undertakings . —
Astrah Products, Ltd. . . . . —
Automatic Light Controlling Co., Ltd. 590

B

Bale & Church, Ltd. 635
Barclay, Andrew, Sons, & Co., Ltd. . 594
Barrowfield Ironworks, Ltd. . . . —
Bates, J., & Sons . . . . . —
Blakeley Firth, Sons, & Co., Ltd. . 636
Braddock, J. & J. . . . Centre VIII., 635
Bratt Colbran & Co. 595
Bray, George, & Co., Ltd. 591
British Aluminium Co., Ltd. . . . —
British Furnaces, Ltd. 609
British Gas Purifying Materials Co. 635
British Steam Specialties, Ltd. . . 638
British Thomson-Houston Co., Ltd. —
Broadbent, Thos., & Son, Ltd. . . —
Broadhead Constructions, Ltd. —
Brockhouse, J., & Co., Ltd. . . . —
Bugden, T., & Co. . . . . —

C

C.C. Fire . . . . . —
Cambridge Instrument Co., Ltd. . —
Cannon Iron Foundries, Ltd. . . . —
Carron Company . . . . . —
Cellactite & British Uralite, Ltd. . —
Chemical Engineering and Wilton's Patent Furnace Co., Ltd. 597
Clapham Bros., Ltd. . . . . —
Clayton, Son, & Co., Ltd. 602
Cochran & Co., Annan, Ltd. . . . —
Cookers & Geysers, Ltd. . . . . —
Cort, Robert, & Son, Ltd. . . . . —
Cowan, W. & B. . . . . Wrapper III.
Crone & Taylor, Ltd. . . . . —
Cutler, Samuel, & Sons, Ltd. . . 631

D

Davis Gas Stove Co., Ltd. . . . . —
Dempster, R. & J., Ltd. . . Wrapper I.
Dempster, R., & Sons, Ltd. Centre II., 636
Denison, Saml., & Son, Ltd. . . . —
Diaphragm & General Leather Co., Ltd. . . . . —
Donkin Co., Ltd. (The Bryan) Wrapper II.
Drayton Regulator and Instrument Co., Ltd. . . . . —
Dry Gasholders, Ltd. . . . . —
Duxbury, Thomas, & Co. Wrapper I., 635

E

E. B. Refractory Cement Co., Ltd. . —
Eagle Range and Grate Co., Ltd. . 593
Economic Gas Boiler Co., Ltd. . . —
Electrolux, Ltd. . . . . —
Evans, Joseph, & Son (Wolverhampton), Ltd. 600
Expanded Metal Company, Ltd. . —

F

F. C. Construction Co., Ltd. . . . —
Falk, Stadelmann, & Co., Ltd. . . 597
Fletcher, Russell, & Co., Ltd. . . —
Foster & Pullen, Ltd. 601
"Four Oaks" Spraying Machine Co. —
Fraser & Chalmers Engineering Works . . . . . —

G

Gas Chambers and Coke Ovens, Ltd. 603
Gas Meter Co., Ltd. . . Wrapper IV., 596
Gas Purification and Chemical Co. Wrapper I., 635
General Gas Appliances, Ltd. . Centre IX.
Gibbons Bros., Ltd. . . . . —
Gibbons (Dudley), Ltd. . . . . —
Gledhill-Brook Time Recorders . . 638
Glenboig Union Fireclay Co., Ltd. 592
Glover, George, & Co., Ltd. . . . 587
Glover, Thos., & Co., Ltd. . . . 610
Goodall, Clayton, & Co., Ltd. . . 594
Grant, David, & Co. 601
Graphite Products, Ltd. . . . . —
Gray, Jas. & Sons . . . . . —
Green & Boulding, Ltd. 633
Griffiths Bros. & Co. (London), Ltd. Wrapper I.

H

Hanley, A. . . . . —
Hardy & Padmore, Ltd. . . . . —
Harper, John, & Co., Ltd. . . . . —
Harris & Pearson, Ltd. 636
Head, Wrightson, & Co., Ltd. . . —
Holmes, W. C., & Co., Ltd. . . . 637
Horseley Bridge and Engineering Company, Ltd. . . . . —
Horstmann Gear Company, Ltd. . . —
Humphreys & Glasgow, Ltd. . . . 608
Huntington Heberlein & Co., Ltd. —
Hurry Water Heater Co. . . . . —
Hutchinson Bros., Ltd. . . . . —

I

Institute of Chemistry . . . . . —

J

Jenkins, W. J., & Co., Ltd. . . . —
Johnson, C. H., & Sons Ltd. . . . —

K

Keith, James, & Blackman Company, Ltd. 640
Kempton, C. H., & Co., Ltd. . . . —
King, Walter, Ltd. . . . . —
King's Patent Agency 635
Kirkham, Hulett, & Chandler, Ltd. —
Kleenoff Co. 635

L

Laidlaw, R., & Son (Edin.), Ltd. . 594
Lead Wool Company, Ltd. . . . —
Le Bas Tube Co., Ltd. 588
Lighting Trades Ltd. . . . . —
Lomas, S. H., & Co. 636
London Electric Firm, The . . . —

M

Macpherson, Donald, & Co., Ltd. . —
Main, R. & A., Ltd. . . . Centre VII.
Manchester Oxide Co., Ltd. . . . —
McKelvie, James, & Co. . . Wrapper I.
Mewburn, Ellis, & Co. 635
Mitchell, H., & Co. . . . . —
Morris Commercial Cars Ltd. . . —

N

National Enamels, Ltd. 589
New Conveyor Co., Ltd. . . . . —
Newton Chambers & Co., Ltd. Centre VI.
Nobel Chemical Finishes, Ltd. . . 599

O

Orme, George, & Co. . . . . —
Oughtibridge Silica Firebrick Co. . 588

P

Parkinson Stove Co., Ltd. . . Centre III.
Parkinson, W., & Co. 592, 610
Pass, E., & Co. . . . . —
Patent Retorts, Ltd. . . . . —
Peckett & Sons, Ltd. 638
Peebles & Co., Ltd. . . . . —
Pegson, Ltd. . . . . —
Pifco, Ltd. 602
Piggott, Thos., & Co., Ltd. . . . —
Potterton, T. (Heating Engineers), Ltd. . . . . —
Pulsometer Engineering Co., Ltd. Wrapper IV.
Purimachos Ltd. 638

R

Radiation Ltd. . Centre IV., V., 593, 607
Reavell & Co., Ltd. 598
Richmonds Gas Stove Co., Ltd. . . —
Robinson, J. H., & Co. (L'pool), Ltd. —
Ross, Chas., Ltd. 635
Rotary Meter Company, Ltd. . . 591
Rotherham & Sons, Ltd. 602
Ruscoe, John, & Co., Ltd. . . . . —

S

Sawer & Purves . . . . . Centre VIII
Scottish Tube Co., Ltd. 600
Sheepbridge Coal and Iron Co., Ltd. —
Siebe, Gorman, & Co., Ltd. . . . 638
Simon-Carves, Ltd. . . . . —
Sisson, W., & Co., Ltd. . . . . —
Smith Meters, Ltd. 605
Solent Engineering Co., Ltd. Wrapper IV.
South Metropolitan Gas Company Wrapper II.
Spencer-Bonecourt, Ltd. 638
Sperryn & Co. . . . . —
Stanton Ironworks Co., Ltd. . . . 635
Staveley Coal and Iron Co., Ltd. 590, 601
Stein, J. G., & Co., Ltd. . . Wrapper I.
Stephens, J. C., & Son, Ltd. . . . —
Stewarts and Lloyds, Ltd. . . . 606
Strachan & Henshaw, Ltd. . . . 587
Stringer Bros. . . . . —
Sugg, Wm., & Co., Ltd. . . . . —
Sutherland Meter Co., Ltd. . . . —

T

Thompson, J. (Wolverhampton), Ltd. 600
Tilley Bros., Ltd. . . . . —
Torbay Paint Company, Ltd. Wrapper I.
Trier Bros., Ltd. . . . . —
Trotter, Haines, and Corbett, Ltd. 633
Tully Sons & Co., Ltd. 588
Turner, F. (Art Metal), Ltd. . . . —

V

Vale, Thos., & Co., Ltd. . . . . —
Valor Co., Ltd. . . . . —
Vertical Gas Retort Synd., Ltd. —
Vickers-Armstrongs, Ltd. . . . . —
Visco Engineering Company, Ltd. —
Vulcan Stove Co., Ltd. . . . . —

W

Wakelin, F. H., Ltd. . . . . —
Walker, C. & W., Ltd. . . . Centre IX.
Walker, Crosweller, & Co., Ltd. . . Wrapper IV.
Waller, Geo., & Son, Ltd. . . . . —
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Westwood & Wrights, Ltd. . . . —
Whessoe Foundry and Eng. Co., Ltd. —
Willey & Co., Ltd. . . . . —
Williamson Cliff, Ltd. . . . . —
Wilson (George) Gas Meters, Ltd. 604
Wilsons & Mathiesons, Ltd. . . . —
Windsor, H., & Co., Ltd. . . . . —
Withinshaw, A. 633
Woodall-Duckham Co., Ltd. . Centre I.
Wright, Alex., & Co., Ltd. . . Wrapper I.
Wright, John, & Co. 607

Appointments Vacant and Wanted 636
Company Notices 633
Contracts Open . . . . . —
Educational 636
Gas-Works Wanted . . . . . —
Patents . . . . . —
Plant, &c., for Sale 636
Publications . . . . . —
Stocks and Shares . . . . . —

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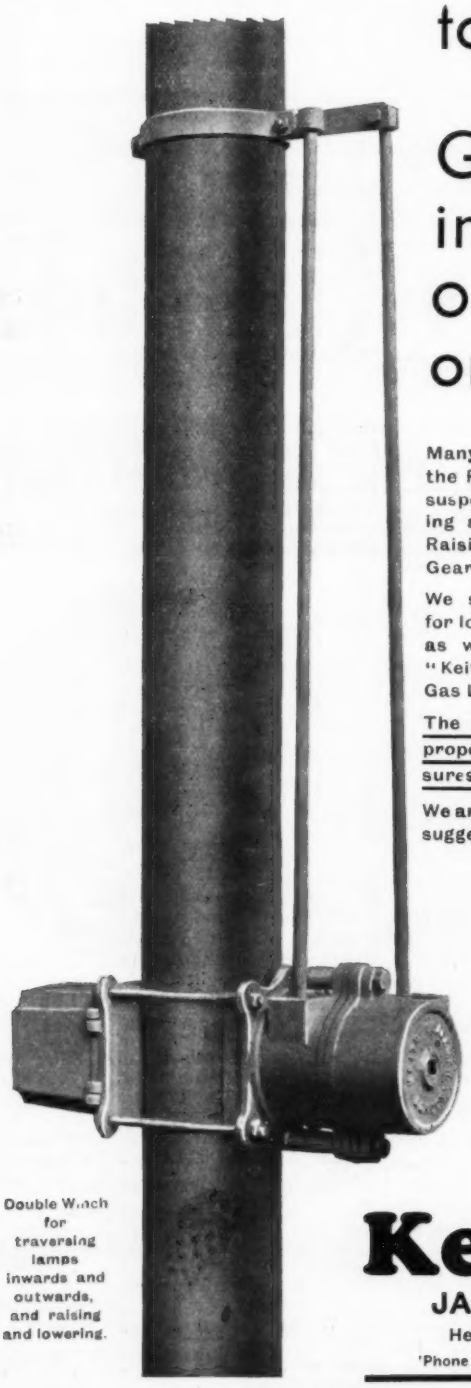

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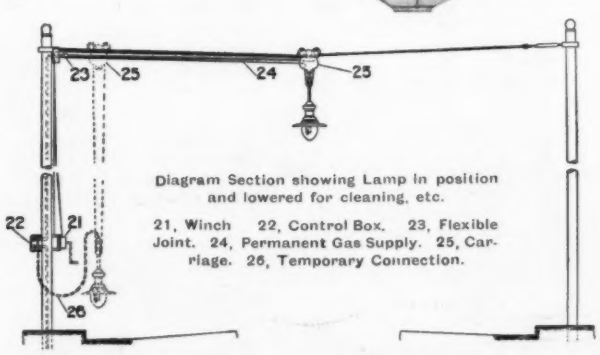

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